Gasoline Blending Streams Analytical Data

Gasoline Blending Streams Category
Test Material Analytical Data Composition Report
of the Petroleum HPV Test Group
Consortium Registration # 1100997

July 31, 2008

Introduction and Explanatory Notes

This report presents compositional data for the test samples used to satisfy the various endpoints of the USEPA High Production Volume Chemical Program for the Gasoline Blending Streams Category.

The data to characterize the hazard potential of Gasoline Blending Streams has been developed over several decades under several different test programs. The test material compositional data has been taken directly from the various analytical data reports for these different programs. The types of test material compositional data presented is essentially the same, however the format for data presentation varies by testing program.

The test material compositional data can be matched to the environmental and health effects Robust Study Summaries by the information provided in the third section of the HPVIS robust study summary entitled:

Test Substance Purity/Composition and
Other Test Substance Comments

The data is organized by testing program. For example, API # 83-05 is the sample number for a petroleum stream tested in the API Streams Program conducted in the 1980's.

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[1] Formulated gasoline does not nave a CASRN on the USEPA TSCA Inventory

OTHER (not associated with a specific testing program)

64741-55-5	Naphtha (Petroleum),Light Catalytic Cracked (Test Material MEHSL CRU # 84152)
64741-55-5	Naphtha (Petroleum),Light Catalytic Cracked (Test Material MEHSL CRU # 86045)
64741-68-0	Naphtha (Petroleum), Heavy Catalytic Reformed (Test Material F-184)
64741-87-3	Naphtha (Petroleum), Sweetened (Test material F-251)
64742-82-1	Naphtha (Petroleum), Hydrodesulfurized Heavy (Test Material F-185)
68513-02-0	Naphtha (Petroleum), Full-Range Coker (Test Material F-250)
none	Light Naphtha n-Hexane Rich (Test Material F-186)
none	Light Naphtha Isohexane Rich (Test Material F-187)

API Streams Data

CAS # 64741-55-5

Naphtha Data Presentation

CLI Log #			DC1236
API Description.			81-03
API Gravity	D287	@60	70.3
Density	D287	@15 C	.7005
Molecular Weight	D2224	gm/mol	82
Refractive Index		RI units	1.4026
Total Sulfur	D3120	ppm/wt	640
Total Nitrogen	Chemil.	ppm/wt	8
Total Oxygen	NAA	wt %	0.029
Total Chloride	coulom.	ppm/wt	<1
Distillation	D86	vol/deg F	
IBP/5			93/106
10/20			113/123
30/40			133/143
50/60			153/168
70/80			185/208
90/95			244/280
End Point			350
Received			99.0
Residue			0.5
Loss			0.5

Hydrocarbon Type Analysis

Saturates	D1319	vol %		56.2
Olefins	"	"		35.3
Aromatics	"	"		8.5
			Total	100.0

High Olefin Mass Spectrometer Analysis

Paraffins	D1019/MS	vol %		42.8
Naphthenes	"	"		10.2
Olefins	"	"		36.5
Aromatics	"	"		10.2
Indans/Tetralins	"	"		0.3
Naphthalenes	"	"		0.0
			Total	100.0

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log #		DC-1236
API Designation		81-03
Component ID by GC/MS	**Component ID by Cap GC**	**Wt %**
Iso-Butane	*	0.13
Isobutene	*	0.07
Butene-1	*	0.12
n-Butane	*	0.83
trans-2-Butene	*	0.58
cis-2-Butene	*	0.66
3-methyl-1-butene	*	0.28
Iso-Pentane	*	13.86
1-Pentene	*	1.16
2-Methyl-1-butene	*	1.86
n-Pentane	*	3.19
2-Methyl-1,3-butadiene	*	0.04
trans-2-Pentene	*	3.12
3,3-Dimethyl-1-butene	*	0.03
cis-2-Pentene	*	1.72
2-Methyl-2-butene	*	4.05
trans-1,3-Pentadiene	*	0.05
Cyclopentadiene	*	0.01
2,2-Dimethylbutane	*	0.07
cis-1,3-Pentadiene	*	0.10
Cyclopentene	*	0.66
4-Methyl-1-pentene + 3-Methyl-1-Pentene	*	0.47
Cyclopentane + C6 olefin	*	0.42
2,3-Dimethylbutane	*	1.57
2,3-Dimethyl-1-butene	*	0.26
2-Methylpentane	*	7.30
4-Methyl-2-pentene	*	0.49
3-Methylpentane	*	4.47
2-Methyl-1-pentene	*	0.82
1-Hexene	*	0.57
n-Hexane	*	1.93
cis-3-Hexene	*	0.87
trans-3-Hexene	*	1.68
trans-2-Hexene	*	1.27
3-Methyl-cis-2-pentene	unknown	0.93
3-Methyl-trans-2-pentene	unknown	0.71
cis-2-Hexene	*	1.19
Methylcyclopentane	*	3.63
N.D.	unknown	0.02

Component ID by GC/MS	Component ID by Cap GC	Wt %
3,4-Dimethyl-1-pentene	unknown	0.07
N.D.	unknown	0.04
N.D.	unknown	0.05
N.D.	unknown	0.05
1-Methylcyclopentene + Benzene	Benzene	2.87
2,4-Dimethyl-1-pentene	unknown	0.09
N.D.	unknown	0.07
Cyclohexane	*	0.26
N.D.	unknown	0.05
2,4-Dimethyl-2-pentene	unknown	0.23
a Dimethylcyclopentene	unknown	0.07
2-Ethyl-3-methylbutene	unknown	0.28
2-Methylhexane	*	3.41
a Cyclohexene	unknown	0.17
3-Methylhexane	*	2.45
C7 Naphthene or olefin	fused	0.10
cis-1,3-Dimethylcyclopentane	*	1.07
trans-1,3-Dimethylcyclopentane	*	0.82
C7 Naphthene or olefin + paraffin	3-ethylpentane + unknown	0.88
N.D.	unknown	0.07
C7 Naphthene or olefin	unknown	0.19
C7 Naphthene or olefin	unknown	0.16
a Methylcyclohexene	unknown	0.32
C7 paraffin	unknown	0.70
n-Heptane	*	0.69
C7 Naphthene or olefin	unknown	0.35
C7 Naphthene or olefin	unknown	0.38
C7 Naphthene or olefin	unknown	0.28
C7 Naphthene or olefin	unknown	0.35
N.D.	unknown	0.12
N.D.	unknown	0.26
a Methylcyclohexene	unknown	0.29
C7 Naphthene or olefin	unknown	0.33
Methylcyclohexane	*	1.62
C7 Naphthene or olefin	ethylcyclopentane	0.13
N.D.	unknown	0.02
C7 Naphthene or olefin	unknown	0.43
2,5-Dimethylhexane	*	0.35
2,4-Dimethylhexane	*	0.32
C7 Naphthene or olefin	unknown	0.24
a Methylcyclohexene	unknown	0.21
N.D.	unknown	0.03
an Ethylcyclopentene	unknown	0.40
Toluene	*	4.66
2,3-Dimethylhexane	unknown	0.13
N.D.	unknown	0.05
a Methylcyclohexene	unknown	0.26

Component ID by GC/MS	Component ID by Cap GC	Wt %
2-Methylheptane	*	0.81
4-Methylheptane	unknown	0.26
1,2,4-trimethylcyclopentane	unknown	0.17
3-Methylheptane	*	1.22
N.D.	unknown	0.11
C8 Paraffin	2,2,5 Trimethylhexane	0.36
C8 Naphthene or olefin	unknown	0.17
C8 Naphthene or olefin	unknown	0.17
C8 Naphthene or olefin	unknown	0.06
C8 Naphthene or olefin	unknown	0.16
a Dimethylcyclohexene or hexadiene	unknown	0.08
C8 Naphthene or olefin	unknown	0.24
n-Octane	n-octane	0.45
C8 Naphthene or olefin	unknown	0.27
a Dimethylcyclohexene or hexadiene	unknown	0.23
C8 Naphthene or olefin	unknown	0.05
C8 Naphthene or olefin	unknown	0.05
C8 Naphthene or olefin	unknown	0.07
C9 Paraffin	unknown	0.13
C8 Naphthene or olefin	unknown	0.08
2,3,5-Trimethylhexane	unknown	0.05
cis-1,2-Dimethylcyclohexane	unknown	0.09
Naphthene or olefin + 2,4-dimethylheptane	*	0.19
2,6-Dimethylheptane	*	0.14
Ethylbenzene	*	0.67
C8 Naphthene or olefin	unknown	0.03
p + m Xylene	*	2.42
2,3-Dimethylheptane	*	0.12
3,4-Dimethylheptane	*	0.18
2-Methyloctane	*	0.19
C9 Naphthene or olefin	unknown	0.04
C9 Naphthene or olefin	unknown	0.02
o-Xylene	*	0.75
C9 Naphthene	*	0.05
C9 Naphthene	unknown	0.02
C9 Naphthene	unknown	0.02
C9 Naphthene or olefin	unknown	0.02
C9 Naphthene or olefin	unknown	0.02
C9 Naphthene or olefin	unknown	0.02
C9 Naphthene or olefin	unknown	0.02
n-Nonane	*	0.09
C10 Paraffin	unknown	0.02
C10 Paraffin	unknown	0.03
C9 Naphthene	unknown	0.02
C10 Paraffin	unknown	0.04
n-Propylbenzene	*	0.08
1-Methyl-3-ethylbenzene	*	0.42
1-Methyl-4-ethylbenzene	*	0.15

Component ID by GC/MS	Component ID by Cap GC	Wt %
1-Methyl-2-ethylbenzene + 4-Methylnonane	*	0.15
1,2,4-Trimethylbenzene	unknown	0.53
n-Decane	*	0.12
1,2,3-Trimethylbenzene	*	0.07
C11 Paraffin	unknown	0.02
Indane	unknown	0.04
1,3-Diethylbenzene	unknown	0.04
1,3-Dimethyl-5-ethylbenzene	unknown	0.04
C11 Paraffin	unknown	0.02
C11 Paraffin	unknown	0.02
C11 Paraffin	unknown	0.02
C10 Alkylbenzene + paraffin	unknown	0.04
2-Methylindane	unknown	0.02
Undecane	unknown	0.08
C10 Alkylbenzene	unknown	0.02
C10 Alkylbenzene	unknown	0.02
5-Methylindane	unknown	0.02
4-Methylindane	unknown	0.02
Naphthalene	*	0.10
	Total	100.00

Note: * indicates capilliary GC ID matches that of GC/MS

Polynuclear Aromatics Data Presentation

CLI Log #	DC-1236
API Designation	81-03

Component	ppm(wt/vol)
Indene	3.7 *
Naphthalene	470
1-Methylnaphthalene	190
2-Methylnaphthalene	280
Acenaphthene	0.52 *
Acenaphthalene	<0.04 *
Fluorene	0.19 *
1,4-Dimethylnaphthalene	6.1 *
Phenanthrene	0.15 *
Fluoranthene	<0.011
Anthracene	<0.120
Pyrene	<0.029
Benz[a]anthrancene	<0.020
Chrysene	<0.10
Benzo[b]fluoranthene	<0.002
Benzo[k]fluoranthene	<0.0004
Benz[a]pyrene	<0.003
Benzo[g,h,i]perylene	<0.003
Indeno[1,2,3,c,d]pyrene	<0.003
Perylene	<0.009
Dibenz[a,h]anthracene	<0.005
Dibenzo[def,p]chrysene	<0.002
9,10-Dimethylanthracene	<0.029
2-Methylanthracene	<0.085
Benzo[a]fluorene	<0.047
7,12-Dimethylbenzene[a]anthracene	<0.0012
Dibenzo[a,e]pyrene	<0.003
Benzo[b]chrysene	<0.003
Picene	<0.014
p-Quarterphenyl	<0.005
Coronene	<0.003
Dibenz[a,h]acridine	<0.0013
Dibenzo[a,h]pyrene	<0.007
3-Methylcholanthrene	<0.0008
2,3-Benzofluorene	<0.08
Benzo[g,h,i]fluoranthene	<0.016
Naphtho[1,2,3,4,def]chrysene	<0.0010

Note: * Indicates data by GC/MS

CAS # 64741-55-5

Naphtha Data Presentation

CLI Log #			DC-1237
API Description.			81-04
API Gravity	D287	@60	60.4
Density	D287	@15 C	.7366
Molecular Weight	D2224	gm/mol	89
Refractive Index		RI units @20 C	1.4234
Total Sulfur	D3120	ppm/wt	460
Total Nitrogen	Chemil.	ppm/wt	24
Total Oxygen	NAA	wt %	0.029
Total Chloride	coulom.	ppm/wt	<1
Distillation	D86	vol/deg F	
IBP/5			100/122
10/20			133/152
30/40			170/187
50/60			211/236
70/80			260/283
90/95			316/340
End Point			359
Received			97.5
Residue			1.0
Loss			1.5

Hydrocarbon Type Analysis

Saturates	D1319	vol %		48.4
Olefins	"	"		30.6
Aromatics	"	"		21.0
			Total	100.0

High Olefin Mass Spectrometer Analysis

Paraffins	D1019/MS	vol %		34.6
Naphthenes	"	"		14.5
Olefins	"	"		29.2
Aromatics	"	"		21.1
Indans/Tetralins	"	"		0.5
Naphthalenes	"	"		0.1
			Total	100.0

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log # DC-1237
API Designation 81-04

Component ID by GC/MS	Component ID by Cap GC	Wt %
Iso-Butane	*	0.09
Isobutene	*	0.09
Butene-1	*	0.14
n-Butane	*	0.40
trans-2-Butene	*	0.68
cis-2-Butene	*	0.77
3-methyl-1-butene	*	0.26
Iso-Pentane	*	8.32
1-Pentene	*	0.86
2-Methyl-1-butene	*	1.44
n-Pentane	*	1.55
2-Methyl-1,3-butadiene	*	0.06
trans-2-Pentene	*	2.20
3,3-Dimethyl-1-butene	*	0.02
cis-2-Pentene	*	1.21
2-Methyl-2-butene	*	2.88
trans-1,3-Pentadiene	*	0.08
Cyclopentadiene	*	0.01
2,2-Dimethylbutane	*	0.03
cis-1,3-Pentadiene	*	0.05
Cyclopentene	*	0.42
4-Methyl-1-pentene + 3-methyl-1-pentene	*	0.33
Cyclopentane + C6 olefin	*	0.23
2,3-Dimethylbutane	*	0.96
2,3-Dimethyl-1-butene	*	0.19
2-Methylpentane	*	4.37
4-Methyl-2-pentene	*	0.35
3-Methylpentane	*	2.77
2-Methyl-1-pentene	*	0.61
1-Hexene	*	0.42
n-Hexane	*	1.18
cis-3-Hexene	*	0.64
trans-3-Hexene	*	1.19
trans-2-Hexene	*	1.07
3-Methyl-cis-2-pentene	unknown	0.59
3-Methyl-trans-2-pentene	unknown	0.52
cis-2-Hexene	*	0.94
Methylcyclopentane	*	2.51

Component ID by GC/MS	Component ID by Cap GC	Wt %
Dimethylpentane	2,2-Dimethylpentane	0.58
C7 Paraffin	2,4-Dimethylpentane	0.08
3,4-Dimethyl-1-pentene	unknown	0.05
N.D.	unknown	0.05
1-Methylcyclopentene	fused	0.94
Benzene	*	0.94
2,4-Dimethyl-1-pentene	unknown	0.07
Cyclohexane	*	0.23
2,4-Dimethyl-2-pentene	unknown	0.18
a Dimethylcyclopentene	unknown	0.03
N.D.	unknown	0.04
2-Ethyl-3-methylbutene	unknown	0.27
2-Methylhexane	*	3.04
a Cyclohexene	fused	0.10
3-Methylhexane	*	2.04
C7 Naphthene or olefin	unknown	0.10
cis-1,3-Dimethylcyclopentane	*	0.91
trans-1,3-Dimethylcyclopentane	*	0.70
C7 Naphthene or olefin	unknown	0.58
C7 Naphthene or olefin	unknown	0.17
C7 Naphthene or olefin	unknown	0.14
a Methylcyclohexene	unknown	0.40
n-Heptane	*	0.60
C7 Naphthene or olefin	unknown	0.14
C7 Naphthene or olefin	unknown	0.31
C7 Naphthene or olefin	unknown	0.23
C7 Naphthene or olefin	unknown	0.31
C7 Naphthene or olefin	unknown	0.07
a Methylcyclohexene	unknown	0.30
C7 Naphthene or olefin	unknown	0.28
Methylcyclohexane	*	1.44
1,1,3-Trimethylpentane	unknown	0.15
C7 Naphthene or olefin	unknown	0.44
2,5-Dimethylhexane	*	0.30
2,4-Dimethylhexane	*	0.34
C7 Naphthene or olefin	unknown	0.29
a Methylcyclohexene	unknown	0.06
an Ethylcyclopentene	unknown	0.27
Toluene	*	4.97
2,3-Dimethylhexane	unknown	0.22
N.D.	unknown	0.06
a Methylcyclohexene	unknown	0.32
N.D.	unknown	0.22
2-Methylheptane	*	1.70
4-Methylheptane	unknown	0.54
1,2,4-trimethylcyclopentane	unknown	0.14

Component ID by GC/MS	Component ID by Cap GC	Wt %
C8 Paraffin	2,2,5-Trimethylhexane	0.22
C7 Naphthene or olefin	unknown	0.08
C8 Naphthene or olefin	unknown	0.14
C8 Naphthene or olefin	unknown	0.10
C8 Naphthene or olefin	unknown	0.34
C8 Naphthene or olefin	unknown	0.37
C8 Naphthene or olefin	unknown	0.11
C8 Naphthene or olefin	unknown	0.08
a Dimethylcyclohexene or hexadiene	unknown	0.15
C8 Naphthene or olefin	unknown	0.23
C8 Naphthene or olefin	unknown	0.38
C8 Naphthene or olefin	unknown	0.07
n-Octane	*	1.35
C8 Naphthene or olefin	unknown	0.47
C8 Naphthene or olefin	unknown	0.20
a Dimethylcyclohexene or hexadiene	unknown	0.23
C8 Naphthene or olefin	unknown	0.10
C8 Naphthene or olefin	unknown	0.20
a Dimethylcyclohexene or hexadiene	unknown	0.04
2,3,5-Trimethylhexane	unknown	0.28
cis-1,2-Dimethylcyclohexane	unknown	0.15
Ethylcyclohexane + 2,4-dimethylheptane	*	0.60
a Dimethylcyclohexene or hexadiene	unknown	0.07
2,6-Dimethylheptane	*	0.60
C9 Paraffin	unknown	0.07
C8 Naphthene or olefin	unknown	0.05
C8 Naphthene or olefin	unknown	0.06
C8 Naphthene or olefin	unknown	0.06
C8 Naphthene or olefin	unknown	0.04
Ethylbenzene	*	1.64
C8 Naphthene or olefin	unknown	0.10
C8 Naphthene or olefin	unknown	0.03
p + m Xylene	*	5.25
2,3-Dimethylheptane	*	0.38
3,4-Dimethylheptane	*	1.21
2-Methyloctane	*	0.12
4-Methyloctane	unknown	1.39
C9 Naphthene or olefin	unknown	0.09
C9 Naphthene or olefin	unknown	0.09
C9 Naphthene or olefin	unknown	0.09
o-Xylene	*	2.04
C9 Naphthene	unknown	0.10
C9 Naphthene	unknown	0.10
C9 Naphthene	unknown	0.07
C9 Naphthene or olefin	unknown	0.10

Component ID by GC/MS	Component ID by Cap GC	Wt %
C9 Naphthene or olefin	unknown	0.08
C9 Naphthene or olefin	unknown	0.07
n-Nonane	*	0.39
C9 Naphthene	unknown	0.06
C9 Naphthene	unknown	0.03
C9 Naphthene	unknown	0.07
C10 Paraffin	unknown	0.07
C9 Naphthene	unknown	0.07
C10 paraffin	unknown	0.06
C10 Paraffin	unknown	0.41
C9 Naphthene	unknown	0.11
n-Propylbenzene	*	0.59
1-Methyl-3-ethylbenzene	*	2.58
1-Methyl-4-ethylbenzene	*	1.00
1,3,5-Trimethylbenzene	unknown	0.81
2-Methylnonane	*	0.45
1-Methyl-2-ethylbenzene	unknown	0.48
4-Methylnonane	unknown	0.39
C9 Naphthene	unknown	0.03
1,2,4-Trimethylbenzene	unknown	2.79
C9 Naphthene	unknown	0.06
n-Decane	*	0.54
1,2,3-Trimethylbenzene	*	0.52
C11 Paraffin	unknown	0.06
C11 Paraffin	unknown	0.08
Indane	unknown	0.32
C11 Paraffin	unknown	0.07
C11 Paraffin	unknown	0.09
C10 Alkylbenzene	unknown	0.17
1,3-Diethylbenzene	unknown	0.31
1-Methyl-4-n-propylbenzene	unknown	0.11
1,3-Dimethyl-5-ethylbenzene	unknown	0.30
C11 Paraffin	unknown	0.11
C10 Alkylbenzene	unknown	0.04
C11 Paraffin	unknown	0.10
C11 Paraffin	unknown	0.14
C10 Alkylbenzene	unknown	0.14
C11 Paraffin	unknown	0.09
2-Methylindane	unknown	0.14
C10 Alkylbenzene	unknown	0.31
Undecane	*	0.14
C10 Alkylbenzene	unknown	0.04
C10 Alkylbenzene	unknown	0.06
5-Methylindane	unknown	0.04
4-Methylindane	unknown	0.03
Naphthalene	*	0.04
	Total	100.00

NOTE: *Indicates capillary GC ID matches that of GC/MS.

Polynuclear Aromatics Data Presentation

CLI Log #	DC-1237
API Designation	81-04

Component	ppm(wt/vol)
Indene	20 *
Naphthalene	86
1-Methylnaphthalene	62
2-Methylnaphthalene	25
Acenaphthene	8.6 *
Acenaphthalene	<0.017 *
Fluorene	<0.15 *
1,4-Dimethylnaphthalene	<0.50 *
Phenanthrene	<0.10 *
Fluoranthene	<0.011
Anthracene	<0.120
Pyrene	<0.029
Benz[a]anthrancene	<0.020
Chrysene	<0.10
Benzo[b]fluoranthene	<0.002
Benzo[k]fluoranthene	<0.0004
Benz[a]pyrene	<0.003
Benzo[g,h,i]perylene	<0.003
Indeno[1,2,3,c,d]pyrene	<0.003
Perylene	<0.009
Dibenz[a,h]anthracene	<0.005
Dibenzo[def,p]chrysene	<0.002
9,10-Dimethylanthracene	<0.029
2-Methylanthracene	<0.085
Benzo[a]fluorene	<0.047
7,12-Dimethylbenzene[a]anthracene	<0.0012
Dibenzo[a,e]pyrene	<0.003
Benzo[b]chrysene	<0.003
Picene	<0.014
p-Quarterphenyl	<0.005
Coronene	<0.003
Dibenz[a,h]acridine	<0.0013
Dibenzo[a,h]pyrene	<0.007
3-Methylcholanthrene	<0.0008
2,3-Benzofluorene	<0.08
Benzo[g,h,i]fluoranthene	<0.016
Naphtho[1,2,3,4,def]chrysene	<0.0010

Note: * indicates data by GC/MS

CAS # 64741-55-5

Naphtha Data Presentation

CSI Log #				50913002
API Description.				83-20
API Gravity	D287	@60		69.5
Density	D287	@15 C		0.7033
Molecular Weight	D2224	gm/mol		91
Refractive Index		RI units		1.4030
Total Sulfur	D3120	wt %		0.035
Total Nitrogen	Chemil.	ppm/wt		6
Total Oxygen	NAA	wt %		0.099
Total Chloride	coulom.	ppm/wt		4
Distillation	D86	vol/deg F		
IBP/5				99/110
10/20				117/126
30/40				138/151
50/60				164/183
70/80				197/219
90/95				254/295
End Point				334
Received				98.5
Residue				1.0
Loss				0.5

Hydrocarbon Type Analysis

Saturates	D1319	vol %		39.5
Olefins	"	"		51.3
Aromatics	"	"		9.2
			Total	100.0
Saturates	NMR	vol %		47.3
Olefins	"	"		41.4
Aromatics	"	"		11.3
			Total	100.0

High Olefin Mass Spectrometer Analysis

Paraffins	D2003/MS	vol %		30.6
Naphthenes	"	"		10.4
Olefins	"	"		45.6
Aromatics	"	"		13.1
Indans/Tetralins	"	"		0.3
Naphthalenes	"	"		0.0
			Total	100.0

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
Isobutane	*	0.47
Isobutene + 1-Butene	*	0.52
n Butane	*	0.27
t-2-Butene	*	0.40
c-2-Butene	*	0.54
3-Methyl-1-butene	*	0.32
Isopentane	*	6.74
1-Pentene	*	1.00
2-Methyl-1-butene	*	0.40
n Pentane	*	0.88
2-Methyl-1,3-butadiene	*	0.02
t-2-Pentene	*	2.90
3,3-Dimethyl-1-butene	*	0.03
c-2-Pentene	*	1.67
2-Methyl-2-butene	*	4.70
t-1,3-Pentadiene	*	0.02
2,2-Dimethylbutane	*	0.03
2,4-Dimethylbutane + Cyclopentadiene	*	0.01
Cyclopentene	*	0.60
4-Methyl-1-pentene	*	0.16
3-Methyl-1-pentene	*	0.22
Cyclopentane	*	0.15
2,3-Dimethylbutane	*	0.91
2,3-Dimethyl-1-butene	*	0.12
4-Methyl-c-2-pentene	*	0.20
4-Methyl-t-2-pentene	*	0.47
2-Methylpentane	*	4.04
3-Methylpentane	*	2.79
2-Methyl-1-pentene	*	0.28
1-Hexene	*	0.49
n-Hexane + 2-Ethyl-1-butene	*	1.56
c-3-Hexene	*	0.68
t-3-Hexene	*	0.30
t-2-Hexene	*	1.41
2-Methyl-2-pentene	*	2.49
3-Methylcyclopentene	*	0.51
3-Methyl-c-2-pentene	*	1.17
4-Methylcyclopentene	*	0.25
3-Methyl-t-2-pentene	*	0.93
c-2-Hexene	*	2.08
2,2-Dimethylpentane	*	0.01
Methylcyclopentane + C6 Olefin	*	2.69
2,4-Dimethylpentane	*	0.39
C7 Olefin	unknown	0.63

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C7 Olefin	unknown	0.01
2,2,3-Trimethylbutane	*	0.02
C7 Olefin	unknown	0.02
C7 Cyclo-olefin	unknown	0.06
C7 Olefin	unknown	0.03
1-Methylcyclopentene	*	2.17
Benzene	*	1.53
C7 Olefin	unknown	0.05
C7 Olefin	unknown	0.03
3,3-Dimethylpentane	*	0.01
C7 Olefin	unknown	0.21
C7 Olefin	unknown	0.06
Cyclohexane	*	0.22
C7 Olefin	unknown	0.19
C7 Cyclo-olefin	unknown	0.04
C7 Cyclo-olefin	unknown	0.04
C7 Cyclo-olefin + C7 Olefin	unknown	0.16
C7 Olefin	unknown	0.38
C7 Olefin	unknown	0.20
2,3-Dimethylpentane	*	0.60
2-Methylhexane	*	2.49
1,1-Dimethylcyclopentane	*	0.03
C7 Cyclo-olefin	unknown	0.30
3-Methylhexane	*	2.22
C7 Olefin	unknown	0.18
t-1,3-Dimethylcyclopentane	*	0.97
C7 Olefin	unknown	0.06
C7 Paraffin	unknown	0.09
c-1,3-Dimethylcyclopentane	*	0.77
C7 Olefin	unknown	0.20
3-Ethylpentane	*	0.13
C7 Olefin	unknown	0.20
2,2,4-Trimethylpentane	*	0.00
t-1,2-Dimethylcyclopentane	*	0.43
C7 Olefin	unknown	0.03
C8 Cyclo-olefin	unknown	0.01
C7 Olefin	unknown	0.27
C7 Olefin	unknown	1.16
C7 Olefin	unknown	1.63
n Heptane	*	1.22
C7 Olefin	unknown	0.37
C7 Olefin	unknown	0.50
C7 Olefin	unknown	0.23
C7 Olefin	unknown	0.01
C8 Olefin	unknown	1.11

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C8 Olefin	unknown	0.63
C8 Olefin	unknown	0.08
C8 Olefin	unknown	0.03
C7 Olefin	unknown	0.07
C7 Olefin	unknown	0.09
C7 Olefin	unknown	0.01
C8 Paraffin	unknown	0.01
Methylcyclohexane + c-1,2-Dimethylcyclopentane	*	1.53
C8 Cyclo-olefin	unknown	0.04
2,2-Dimethylhexane + C7 Naphthene	*	0.14
C8 Cyclo-olefin	unknown	0.04
C7 Olefin	unknown	0.07
C8 Paraffin + C8 Olefin	unknown	0.15
C7 Cyclo-olefin	unknown	0.16
2,5-Dimethylhexane + Ethylcyclopentane	*	0.45
C8 Paraffin	unknown	0.21
2,4-Dimethylhexane + 2,2,3-Trimethylpentane	*	0.31
C8 Olefin	unknown	0.03
C8 Olefin	unknown	0.12
a 1,2,4-Trimethylcyclopentane	*	0.27
3,3-Dimethylhexane	*	0.01
C8 Cyclo-olefin	unknown	0.08
C8 Olefin	unknown	0.05
C7 Cyclo-olefin	unknown	1.14
C8 Olefin	unknown	0.26
a 1,2,3-Trimethylcyclopentane	*	0.09
Toluene	*	5.72
C8 Olefin	unknown	0.09
C8 Olefin	unknown	0.16
C8 Olefin	unknown	0.16
C8 Cyclo-olefin	unknown	0.40
C8 Olefin	unknown	0.08
2,3-Dimethylhexane	*	0.14
C8 Olefin	unknown	0.04
C8 Paraffin	unknown	0.05
C8 Olefin	unknown	0.04
C8 Olefin	unknown	0.08
C8 Paraffin	unknown	0.03
C8 Olefin	unknown	0.06
2-Methylheptane	*	0.79
C8 Paraffin	unknown	0.03
4-Methylheptane	*	0.25

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C8 Paraffin	unknown	0.07
C8 Paraffin	unknown	0.05
C8 Paraffin	unknown	0.13
C8 Paraffin	unknown	0.01
3-Methylheptane	*	0.71
C8 Naphthene	unknown	0.11
C8 Olefin	unknown	0.09
C8 Naphthene	unknown	0.31
C8 Olefin	unknown	0.09
t-1,4-Dimethylcyclohexane	*	0.11
C8 Olefin	unknown	0.06
C8 Olefin	unknown	0.06
C8 Olefin	unknown	0.10
C8 Olefin	unknown	0.35
C8 Olefin	unknown	0.01
1,2,3-Trimethylcyclopentane	*	0.22
C8 Olefin	unknown	0.33
C8 Olefin	unknown	0.06
a Dimethylcyclohexane	*	0.17
C8 Olefin	unknown	0.04
1-Methyl-1-ethylcyclopentane	*	0.07
C8 Olefin	unknown	0.18
C8 Olefin	unknown	0.09
C8 Olefin	unknown	0.03
C8 Olefin	unknown	0.11
C8 Olefin	unknown	0.05
C8 Naphthene	unknown	0.05
C8 Olefin + C9 Olefin	unknown	0.46
C9 Cyclo-olefin	unknown	0.02
n Octane + t-1,2-Dimethylcyclohexane	*	0.26
C8 Olefin	unknown	0.03
C8 Olefin	unknown	0.07
C8 Naphthene	unknown	0.21
C8 Olefin	unknown	0.01
C8 Olefin	unknown	0.03
C8 Olefin	unknown	0.01
C9 Naphthene	unknown	0.05
C8 Cyclo-olefin	unknown	0.04
C8 Cyclo-olefin + C9 Olefin	unknown	0.08
C9 Olefin	unknown	0.06
C9 Paraffin	unknown	0.01
C9 Cyclo-olefin	unknown	0.02
C9 Olefin	unknown	0.03
Isopropylcyclopentane	*	0.07
C9 Olefin	unknown	0.02

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
2,6-Dimethylheptane	*	0.06
C9 Olefin	unknown	0.11
c-1,2-Dimethylcyclohexane	*	0.07
C8 Naphthene	unknown	0.01
C9 Paraffin	unknown	0.14
C9 Olefin	unknown	0.04
C8 Naphthene	unknown	0.08
C9 Cyclo-olefin	unknown	0.03
C9 Naphthene	unknown	0.03
C9 Olefin	unknown	0.03
C9 Olefin	unknown	0.01
3,3 + 3,5-Dimethylheptane	*	0.18
C9 Paraffin	unknown	0.03
Ethylbenzene	*	0.90
1,3,5-Trimethylcyclohexane	*	0.02
1,1,4-Trimethylcyclohexane	*	0.04
C9 Olefin	unknown	0.02
C9 Naphthene	unknown	0.03
C9 Olefin	unknown	0.01
C9 Olefin	unknown	0.01
C9 Olefin	unknown	0.01
m-Xylene	*	2.49
C9 Naphthene	unknown	0.03
p-Xylene	*	0.75
C9 Naphthene	unknown	0.04
C9 Olefin	unknown	0.02
C9 Olefin	unknown	0.03
C9 Naphthene	unknown	0.01
C9 Cyclo-olefin	unknown	0.05
C9 Naphthene	unknown	0.02
C9 Olefin	unknown	0.01
C9 Olefin	unknown	0.04
2,3-Dimethylheptane	*	0.04
C9 Olefin	unknown	0.01
C9 Cyclo-olefin	unknown	0.03
C9 Paraffin	unknown	0.01
C9 Paraffin	unknown	0.01
C9 Olefin	unknown	0.01
C9 Paraffin	unknown	0.02
C9 Olefin	unknown	0.01
C9 Naphthene	unknown	0.03
C9 Olefin	unknown	0.03
4-Methyloctane	*	0.16
2-Methyloctane	*	0.20
C9 Olefin	unknown	0.03

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C9 Olefin	unknown	0.01
C9 Olefin	unknown	0.02
C9 Paraffin	unknown	0.04
o-Xylene	*	1.07
3-Methyloctane	*	0.20
C9 Olefin	unknown	0.01
C9 Naphthene	unknown	0.01
C9 Olefin	unknown	0.05
C9 Naphthene	unknown	0.04
C9 Olefin	unknown	0.03
C9 Naphthene	unknown	0.01
C9 Naphthene	unknown	0.03
C9 Olefin	unknown	0.03
C9 Olefin	unknown	0.01
1,1,2-Trimethylcyclohexane	*	0.02
C9 Olefin	unknown	0.07
C9 Naphthene	unknown	0.04
C9 Olefin	unknown	0.04
C9 Naphthene	unknown	0.06
C9 Olefin	unknown	0.06
C9 Naphthene	unknown	0.02
n-Nonane	*	0.01
C9 Olefin	unknown	0.03
Isobutylcyclopentane	*	0.02
C10 Naphthene	unknown	0.01
C9 Olefin	unknown	0.03
C9 Olefin	unknown	0.02
n Nonane	*	0.10
C9 Olefin	unknown	0.01
C9 Naphthene	unknown	0.01
Isopropylbenzene	*	0.03
C9 Naphthene	unknown	0.04
C9 Naphthene	unknown	0.01
C10 Cyclo-olefin	unknown	0.01
C10 Paraffin	unknown	0.01
C10 Olefin	unknown	0.01
C9 Naphthene	unknown	0.01
C10 Olefin	unknown	0.01
C9 Naphthene	unknown	0.03
C10 Olefin	unknown	0.03
2,2 Dimethyloctane	*	0.03
C9 Naphthene	unknown	0.01
C9 Naphthene	unknown	0.01
C9 Naphthene	unknown	0.01
C10 Paraffin	unknown	0.03

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C9 Naphthene	unknown	0.01
C9 Naphthene	unknown	0.02
C10 Paraffin	unknown	0.02
C10 Naphthene	unknown	0.03
n-Propylbenzene	*	0.14
2,6-Dimethyloctane	*	0.05
C10 Olefin	unknown	0.02
3,3-Dimethyloctane + C10 Naphthene	*	0.03
1-Methyl-3-ethylbenzene	*	0.68
C10 Naphthene	unknown	0.02
1-Methyl-4-ethylbenzene	*	0.26
C10 Naphthene	unknown	0.01
C10 Naphthene	unknown	0.01
C10 Paraffin	unknown	0.01
C10 Naphthene	unknown	0.01
C10 Paraffin + C10 Naphthene	unknown	0.01
1,3,5-Trimethylbenzene	*	0.30
C10 Olefin	unknown	0.02
2,3-Dimethyloctane	*	0.04
C10 Olefin	unknown	0.01
1-Methyl-2-ethylbenzene	*	0.20
C10 Paraffin	unknown	0.03
4-Methylnonane	*	0.05
C10 Olefin	unknown	0.02
2-Methylnonane	*	0.07
C10 Olefin	unknown	0.02
3-Ethyloctane	*	0.01
3-Methylnonane	*	0.06
C10 Dinaphthene	unknown	0.01
1,2,4-Trimethylbenzene	*	0.86
C10 Olefin	unknown	0.01
C10 Naphthene	unknown	0.01
C10 Olefin	unknown	0.01
Isobutylcyclohexane	*	0.02
C10 Olefin	unknown	0.01
Isobutylbenzene	*	0.01
C10 Naphthene	unknown	0.01
s-Butylbenzene	*	0.03
n-Decane	*	0.05
C10 Naphthene	unknown	0.01
1,2,3-Trimethylbenzene + 1-Methyl-3-isopropylbenzene	*	0.21
C10 Cyclo-olefin	unknown	0.01
Indan	*	0.15
C10 Naphthene	unknown	0.01

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C11 Paraffin	unknown	0.01
C11 Paraffin	unknown	0.01
C11 Paraffin	unknown	0.02
1,3-Diethylbenzene	*	0.06
C10 Naphthene	unknown	0.01
1-Methyl-3-n-propylbenzene	*	0.11
C11 Paraffin	unknown	0.02
1-Methyl-4-n-propylbenzene	*	0.06
n-Butylbenzene	*	0.03
C11 Naphthene	unknown	0.01
1,2-Diethylbenzene	*	0.11
1,4-Diethylbenzene	*	0.01
1-Methyl-2-n-propylbenzene	*	0.04
C11 Naphthene	unknown	0.01
C11 Naphthene	unknown	0.01
C11 Paraffin	unknown	0.02
1,4-Dimethyl-2-ethylbenzene	*	0.07
C11 Paraffin	unknown	0.01
1,3-Dimethyl-4-ethylbenzene	*	0.07
C11 Paraffin	unknown	0.02
Methylindan	*	0.03
1,2-Dimethyl-4-ethylbenzene	*	0.19
C11 Paraffin	unknown	0.02
C11 Naphthene	unknown	0.01
C11 Aromatic	unknown	0.01
C11 Indan/Tetralin	unknown	0.03
C11 Aromatic	unknown	0.01
n-Undecane	*	0.03
1,2,4,5-Tetramethylbenzene + C11 Aromatic	*	0.06
1,2,3,5-Tetramethylbenzene	*	0.06
C11 Aromatic	unknown	0.02
C11 Indan/Tetralin	unknown	0.08
N.D.	unknown	0.02
C11 Aromatic	unknown	0.01
C11 Aromatic	unknown	0.01
C11 Indan/Tetralin	unknown	0.08
C11 Aromatic	unknown	0.03
C11 Aromatic	unknown	0.02
C11 Indan/Tetralin	unknown	0.03
C11 Aromatic	unknown	0.04
C11 Aromatic	unknown	0.01
C11 Aromatic	unknown	0.02
C11 Aromatic	unknown	0.02
Naphthalene + C11 Olefin	*	0.08

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913002
API Designation		83-20
Component ID by GC/MS	Component ID by Cap GC	Wt. %
C11 Indan/Tetralin	unknown	0.01
C12 Aromatic	unknown	0.01
C11 Aromatic + C11 Indan/Tetralin	unknown	0.08
C11 Indan/Tetralin	unknown	0.02
C12 Aromatic + C12 Indan/Tetralin	unknown	0.04
C11 Aromatic	unknown	0.01
C12 Indan/Tetralin	unknown	0.01
n-Dodecane	*	0.02
C11 Aromatic	unknown	0.02
C11 Indan/Tetralin	unknown	0.01
C11 Aromatic	unknown	0.01
2-Methylnaphthalene	*	0.01
1-Methylnaphthalene	*	0.01
n-Tridecane	*	0.01
		100.00

Note: * indicates that capilliary GC ID matches that of GC/MS

Polynuclear Aromatics Data Presentation

CSI Log #	50913002
API Designation	83-20

Component	ppm(wt/vol)	
Indene	2.9	
Naphthalene	240	
1-Methylnaphthalene	50	
2-Methylnaphthalene	100	
Acenaphthene	0.5	*
Acenaphthalene	1.1	*
Fluorene	0.3	*
1,4-Dimethylnaphthalene	2.9	*
Phenanthrene	0.42	*
Fluoranthene	< 1.0	
Anthracene	< 0.5	*
Pyrene	< 0.5	*
Benz[a]anthrancene	< 0.3	
Chrysene	< 0.6	
Benzo[b]fluoranthene	< 0.3	
Benzo[k]fluoranthene	< 0.15	
Benz[a]pyrene	< 0.15	
Benzo[g,h,i]perylene	< 0.6	
Indeno[1,2,3,c,d]pyrene	< 0.6	
Perylene	< 1.0	
Dibenz[a,h]anthracene	< 0.3	
Dibenzo[def,p]chrysene	< 0.12	
9,10-Dimethylanthracene	< 2.0	*
2-Methylanthracene	< 2.0	*
Benzo[a]fluorene	< 2.0	*
Dibenzo[a,e]pyrene	< 0.18	
Benzo[b]chrysene	< 0.18	
Picene	< 0.6	
p-Quarterphenyl	< 0.2	
Coronene	< 0.18	
Dibenz[a,h]acridine	< 0.08	
Dibenzo[a,h]pyrene	< 0.4	
3-Methylcholanthrene	< 0.04	
2,3-Benzofluorene	< 2.0	*
Benzo[g,h,i]fluoranthene	< 1.0	
Naphtho[1,2,3,4,def]chrysene	< 0.06	

Note: * Indicates data by GC/MS

CAS # 64741-63-5

Naphtha Data Presentation

CLI Log #			DC1245
API Description.			83-04
API Gravity	D287	@60	56.0
Density	D287	@15 C	.7539
Molecular Weight	D2224	gm/mol	90
Refractive Index		RI units @19 C	1.4289
Total Sulfur	D3120	ppm/wt	<1
Total Nitrogen	Chemil.	ppm/wt	<1
Total Oxygen	NAA	wt %	N.A.
Total Chloride	coulom.	ppm/wt	2
Distillation	D86	vol/deg F	
IBP/5			120/137
10/20			149/167
30/40			181/204
50/60			209/215
70/80			222/234
90/95			247/257
End Point			277
Received			99.5
Residue			0.5
Loss			0.0

Hydrocarbon Type Analysis

Saturates	D1319	vol %		58.9
Olefins	"	"		1.1
Aromatics	"	"		40.0
			Total	100.0

Mass Spectrometer Analysis (D2789)

Paraffins	D2789/MS	vol %		52.1
Naphthenes	"	"		5.4
Aromatics	"	"		42.1
Indans/Tetralins	"	"		0.4
Naphthalenes	"	"		0.0
			Total	100.0

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log # DC-1245
API Designation 83-04

Component ID by GC/MS	Component ID by Cap GC	Wt %
Iso-Butane	*	0.01
n-Butane	*	0.05
Iso-Pentane	*	5.49
1-Pentene	*	0.01
2-Methyl-1-butene	*	0.02
n-Pentane	*	4.35
trans-2-Pentene	*	0.02
cis-2-Pentene	*	0.01
2-Methyl-2-butene	*	0.06
2,2-Dimethylbutane	*	0.61
Cyclopentane	*	0.17
2,3-Dimethylbutane	*	0.74
2-Methylpentane	*	4.17
3-Methylpentane	*	3.21
Hexene-1	*	0.01
n-Hexane	*	3.93
C6 Olefin	unknown	0.01
C6 Olefin	unknown	0.02
cis-2-Hexene	*	0.01
trans-2-Hexene	*	0.01
C6 Olefin	unknown	0.01
C7 Paraffin	N.D.	0.59
Methylcyclopentane	*	1.19
2,2-Dimethylpentane	*	1.17
2,4-Dimethylpentane	*	0.03
Benzene	*	5.02
3,3-Dimethylpentane	*	0.96
Cyclohexane	*	0.13
2-Methylhexane	*	3.96
2,3-Dimethylpentane	*	1.54
1,1-Dimethylcyclopentane	*	0.14
3-Methylhexane	*	4.79
cis-1,3-Dimethylcyclopentane	*	0.14
trans-1,3-Dimethylcyclopentane	*	0.11
2-Ethylpentane	*	0.64
trans-1,2-Dimethylcyclopentane	*	0.18
n-Heptane	*	3.53
C7 Naphthene or olefin	unknown	0.03
C7 Naphthene or olefin	unknown	0.02
cis-1,2-Dimethylcyclopentane	*	0.07
Methylcyclohexane	*	0.19

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log #	DC-1245
API Designation	83-04

Component ID by GC/MS	Component ID by Cap GC	Wt %
Ethylcyclopentane	*	0.38
2,4-Dimethylhexane	*	0.68
1,2,4-Trimethylcyclopentane	*	0.05
2,2,3-Trimethylpentane	*	0.16
C8 Naphthene	1,2,4 Trimethylcyclopentane	0.02
Toluene	*	28.75
3,3-Dimethylhexane	*	0.39
2,3,4-Trimethylpentane	*	0.10
2-Methylheptane	*	1.47
4-Methylheptane	*	0.75
3,4-Dimethylhexane	*	0.22
3-Methylheptane	*	2.23
3-Methyl-3-ethylpentane	*	0.29
C8 Paraffin	*	0.04
C8 Naphthene	unknown	0.08
1-Methyl-1-ethylcyclopentane	unknown	0.08
1,2,3-Trimethylcyclopentane	unknown	0.09
n-Octane	*	1.27
2,4,4-Trimethylhexane	unknown	0.01
2,3,5-Trimethylhexane	unknown	0.02
2,2-Dimethylheptane	*	0.05
2,2-Dimethyl-3-ethylpentane	unknown	0.05
2,4-Dimethylheptane	fused	0.10
Ethylbenzene	*	3.24
p-Xylene	*	2.82
m-Xylene	*	6.37
N.D.	3,4 Dimethylheptane	0.08
4-Methyloctane	*	0.17
2-Methyloctane	*	0.18
3-Methyloctane	unknown	0.03
2,2,4,5-Tetramethylhexane	unknown	0.13
o-Xylene	*	2.19
N.D.	Isopropylbenzene	0.04
n-Nonane	*	0.06
n-Propylbenzene	*	0.01
1-Methyl-3-ethylbenzene	unknown	0.04
1-Methyl-4-ethylbenzene	unknown	0.01
	Total	100.00

NOTE: *Indicates capillary GC ID matches that of GC/MS.

Polynuclear Aromatics Data Presentation

CLI Log #	DC-1245
API Designation	83-04

Component	ppm(wt/vol)
Indene	0.014 *
Naphthalene	0.83 *
1-Methylnaphthalene	0.07 *
2-Methylnaphthalene	0.14 *
Acenaphthene	<0.04 *
Acenaphthalene	<0.039 *
Fluorene	<0.06 *
1,4-Dimethylnaphthalene	<0.1 *
Phenanthrene	0.026 *
Fluoranthene	<0.011
Anthracene	<0.02 *
Pyrene	<0.029
Benz[a]anthrancene	<0.020
Chrysene	<0.10
Benzo[b]fluoranthene	<0.002
Benzo[k]fluoranthene	<0.0004
Benz[a]pyrene	<0.003
Benzo[g,h,i]perylene	<0.003
Indeno[1,2,3,c,d]pyrene	<0.003
Perylene	<0.009
Dibenz[a,h]anthracene	<0.005
Dibenzo[def,p]chrysene	<0.002
9,10-Dimethylanthracene	<0.029
2-Methylanthracene	<0.085
Benzo[a]fluorene	<0.047
7,12-Dimethylbenzene[a]anthracene	<0.0012
Dibenzo[a,e]pyrene	<0.003
Benzo[b]chrysene	<0.003
Picene	<0.014
p-Quarterphenyl	<0.005
Coronene	<0.003
Dibenz[a,h]acridine	<0.0013
Dibenzo[a,h]pyrene	<0.007
3-Methylcholanthrene	<0.0008
2,3-Benzofluorene	<0.08
Benzo[g,h,i]fluoranthene	<0.016
Naphtho[1,2,3,4,def]chrysene	<0.0010

Note: * Indicates data by GC/MS

CAS# 64741-66-8

Naphtha Data Presentation

CSI Log #			50719001
API Description.			83-19
API Gravity	D287	@60	71.3
Density	D287	@15 C	0.6970
Molecular Weight	D2224	gm/mol	111
Refractive Index		RI units @20 C	1.3925
Total Sulfur	D3120	ppm/wt	30
Total Nitrogen	Chemil.	ppm/wt	<1
Total Oxygen	NAA	wt %	<0.02
Total Chloride	coulom.	ppm/wt	3
Distillation	D86	vol/deg F	
IBP/5			98/135
10/20			155/186
30/40			199/214
50/60			223/229
70/80			232/238
90/95			251/277
End Point			347
Received			98.0
Residue			1.0
Loss			1.0

Hydrocarbon Type Analysis

Saturates	D1319	vol %		99.9
Olefins	"	"		<0.1
Aromatics	"	"		<0.1
			Total	100.0

Mass Spectrometer Analysis (D2789)

Paraffins	D2789/MS	vol %		99.4
Naphthenes	"	"		0.6
Olefins	"	"		0.0
Aromatics	"	"		0.0
Indans/Tetralins	"	"		0.0
Naphthalenes	"	"		0.0
			Total	100.0

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50719001
API Designation		83-19
Component ID by GC/MS	Component ID by Cap GC	Wt %
Isobutane	*	0.39
n-Butane	*	3.44
Isopentane	*	7.68
n-Pentane	*	0.06
2,3-Dimethylbutane	*	4.43
2-Methylpentane	*	1.14
3-Methylpentane	*	0.50
2,4-Dimethylpentane	*	3.04
2,2,3-Trimethylbutane	*	0.24
C7 isoparaffin	unknown	0.24
2,3-Dimethylpentane	*	1.65
3-Methylhexane	*	0.17
2,2,4-Trimethylpentane	*	25.70
2,5-Dimethylhexane	*	3.71
2,4-Dimethylhexane	*	4.78
2,3,4-Trimethylpentane	*	11.42
2,3,3-Trimethylpentane	*	13.65
2,3-Dimethylhexane	*	2.77
C8 isoparaffin	unknown	0.07
C8 isoparaffin	unknown	0.43
C8 isoparaffin	unknown	0.06
2,2,5-Trimethylhexane	*	5.62
C9 isoparaffin	unknown	0.05
C9 isoparaffin	unknown	0.13
2,3,5-Trimethylhexane	*	0.81
C9 isoparaffin	unknown	0.09
C9 isoparaffin	unknown	0.12
C9 isoparaffin	unknown	0.28
C9 isoparaffin	unknown	0.06
C9 isoparaffin	unknown	0.08
C9 isoparaffin	unknown	0.04
C9 isoparaffin	unknown	0.15
C9 isoparaffin	unknown	0.05
C9 isoparaffin	unknown	0.42
C9 isoparaffin	unknown	0.81
C9 isoparaffin	unknown	0.54
C10 isoparaffin	unknown	0.34
C10 isoparaffin	unknown	0.22
C10 isoparaffin	unknown	0.06
C10 isoparaffin	unknown	0.12
C10 isoparaffin	unknown	1.39
C10 isoparaffin	unknown	0.27
C10 isoparaffin	unknown	0.11
C10 isoparaffin	unknown	0.18

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50719001
API Designation		83-19
Component ID by GC/MS	Component ID by Cap GC	Wt %
C10 isoparaffin	unknown	0.10
C10 isoparaffin	unknown	0.20
C10 isoparaffin	unknown	0.06
C10 isoparaffin	unknown	0.11
C10 isoparaffin	unknown	0.06
C11 isoparaffin	unknown	0.10
C11 isoparaffin	unknown	0.49
C11 isoparaffin	unknown	0.16
C11 isoparaffin	unknown	0.46
C11 isoparaffin	unknown	0.09
C11 isoparaffin	unknown	0.21
C11 isoparaffin	unknown	0.06
C11 isoparaffin	unknown	0.15
C11 isoparaffin	unknown	0.10
	Total	100.00

Note: * indicates that Cap GC ID matches that of GC/MS.

Polynuclear Aromatics Data Presentation

CSI Log #	50719001
API Designation	83-19

Component	ppm(wt/vol)
Indene	<2.0*
Naphthalene	17 *
1-Methylnaphthalene	8 *
2-Methylnaphthalene	15 *
Acenaphthene	<0.5
Acenaphthalene	<0.5
Fluorene	<0.4
1,4-Dimethylnaphthalene	<1.0
Phenanthrene	<1.0
Fluoranthene	<0.01
Anthracene	<1.0
Pyrene	<0.2
Benz[a]anthrancene	<0.02
Chrysene	<0.2
Benzo[b]fluoranthene	<0.004
Benzo[k]fluoranthene	<0.002
Benz[a]pyrene	<0.015
Benzo[g,h,i]perylene	<0.06
Indeno[1,2,3,c,d]pyrene	<0.02
Perylene	<0.09
Dibenz[a,h]anthracene	<0.04
Dibenzo[def,p]chrysene	<0.02
9,10-Dimethylanthracene	<0.3
2-Methylanthracene	<0.8
Benzo[a]fluorene	<0.8 *
7,12-Dimethylbenzene[a]anthracene	<0.01
Dibenzo[a,e]pyrene	<0.03
Benzo[b]chrysene	<0.03
Picene	<0.14
p-Quarterphenyl	<0.05
Coronene	<0.03
Dibenz[a,h]acridine	<0.013
Dibenzo[a,h]pyrene	<0.07
3-Methylcholanthrene	<0.008
2,3-Benzofluorene	<0.8
Benzo[g,h,i]fluoranthene	<0.15
Naphtho[1,2,3,4,def]chrysene	<0.01

Note: * Indicates data by GC/MS

CAS # 64741-68-0

Naphtha Data Presentation

CSI Log #			50913001
API Description.			83-06
API Gravity	D287	@60	34.0
Density	D287	@15 C	0.8541
Molecular Weight	D2224	gm/mol	106
Refractive Index		RI units	1.4885
Total Sulfur	D3120	ppm/wt	< 2
Total Nitrogen	Chemil.	ppm/wt	< 1
Total Oxygen	NAA	wt %	< 0.02
Total Chloride	coulom.	ppm/wt	5
Distillation	D86	vol/deg F	
IBP/5			253/265
10/20			268/275
30/40			279/285
50/60			290/296
70/80			307/315
90/95			334/342
End Point			360
Received			99.0
Residue			1.0
Loss			0.0

Hydrocarbon Type Analysis

Saturates	D1319	vol %		7.2
Olefins	"	"		< 0.1
Aromatics	"	"		92.8
			Total	100.0

High Olefin Mass Spectrometer Analysis

Paraffins	D2003/MS	vol %		9.4
Naphthenes	"	"		0.1
Olefins	"	"		< 0.1
Aromatics	"	"		89.8
Indans/Tetralins	"	"		0.6
Naphthalenes	"	"		0.1
			Total	100.0

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913001
API Designation		83-06
Component ID by GC/MS	Component ID by Cap GC	Wt. %
3,3-Dimethylhexane	*	0.03
Toluene	*	15.08
2,3-Dimethylhexane	*	0.28
2-Methylheptane	*	1.14
4-Methylheptane	*	0.78
3-Methylheptane	*	0.73
C8 Paraffin	unknown	0.96
3-Ethylhexane	*	0.26
C8 Naphthene	unknown	0.01
t-1,2-Dimethylcyclohexane	*	0.02
n Octane	*	1.37
2,3,5-Trimethylhexane	*	0.02
2,2-Dimethylheptane	*	0.06
2,4-Dimethylheptane	*	0.09
1,1,3-Trimethylcyclohexane	*	0.01
C9 Paraffin	unknown	0.02
2,6-Dimethylheptane	*	0.07
2,5 + 3,5-Dimethylheptane	*	0.22
3,3-Dimethylheptane	*	0.08
Ethylbenzene	*	7.38
m-Xylene	*	16.50
p-Xylene	*	5.51
2,3 + 3,4-Dimethylheptane	*	0.09
C9 Paraffin	unknown	0.06
4-Methyloctane	*	0.29
2-Methyloctane	*	0.32
C9 Paraffin	unknown	0.08
3-Methyloctane	*	0.40
o-Xylene	*	9.28
n Nonane	*	0.33
Isopropylbenzene	*	0.59
2,2 Dimethyloctane	*	0.02
2,6 + 3,6-Dimethyloctane	*	0.02
n-Propylbenzene	*	2.06
1-Methyl-3-ethylbenzene	*	5.71
1-Methyl-4-ethylbenzene	*	2.56
1,3,5-Trimethylbenzene	*	2.65
C10 Paraffin	unknown	0.02
1-Methyl-2-ethylbenzene	*	2.45
3-Methylnonane	*	0.06
1,2,4-Trimethylbenzene + t-Butylbenzene	*	9.85
Isobutylbenzene	*	0.15
s-Butylbenzene	*	0.17

Naphtha Component Analysis by Capilliary GC and GC/MS

CSI Log #		50913001
API Designation		83-06
Component ID by GC/MS	Component ID by Cap GC	Wt. %
n-Decane	*	0.05
1,2,3-Trimethylbenzene	*	2.13
1-Methyl-3-isopropylbenzene	*	0.31
1-Methyl-4-isopropylbenzene	*	0.08
Indan	*	0.48
Indene	*	0.02
1-Methyl-2-isopropylbenzene	*	0.02
1,3-Diethylbenzene	*	0.42
1-Methyl-4-n-propylbenzene	*	1.14
n-Butylbenzene	*	0.95
1,2-Diethylbenzene	*	1.02
1,4-Diethylbenzene	*	0.07
1-Methyl-2-n-propylbenzene	*	0.40
1,4-Dimethyl-2-ethylbenzene	*	0.68
1,3-Dimethyl-4-ethylbenzene	*	0.63
1,2-Dimethyl-4-ethylbenzene	*	1.19
1,3-Dimethyl-2-ethylbenzene	*	0.06
1,2-Dimethyl-3-ethylbenzene	*	0.33
C11 Aromatic	unknown	0.02
1,2,4,5-Tetramethylbenzene	*	0.58
1,2,3,5-Tetramethylbenzene	*	0.74
Methylindan	*	0.08
1,2,3,4-Tetramethylbenzene	*	0.09
C11 Aromatic + C10 Indan/Tetralin	unknown	0.07
C11 Aromatic + C10 Indan/Tetralin	unknown	0.22
C11 Aromatic	unknown	0.14
C11 Aromatic	unknown	0.04
C11 Aromatic	unknown	0.06
C11 Aromatic	unknown	0.02
C11 Aromatic + C11 Indan/Tetralin	unknown	0.03
Naphthalene	*	0.12
C11 Aromatic + C11 Indan/Tetralin	unknown	0.02
C11 Aromatic	unknown	0.01
	Total	100.00

Note: * indicates capilliary GC ID matches that of GC/MS

Polynuclear Aromatics Data Presentation

CSI Log #	50913001
API Designation	83-06

Component	ppm(wt/vol)	
Indene	N.A.	
Naphthalene	370	*
1-Methylnaphthalene	7	*
2-Methylnaphthalene	13	*
Acenaphthene	< 0.25	*
Acenaphthalene	< 0.25	*
Fluorene	< 0.25	*
1,4-Dimethylnaphthalene	0.75	*
Phenanthrene	0.6	*
Fluoranthene	< 1.0	
Anthracene	< 0.5	*
Pyrene	1.1	*
Benz[a]anthrancene	< 0.3	
Chrysene	< 0.6	
Benzo[b]fluoranthene	< 0.3	
Benzo[k]fluoranthene	< 0.15	
Benz[a]pyrene	< 0.15	
Benzo[g,h,i]perylene	< 0.6	
Indeno[1,2,3,c,d]pyrene	< 0.6	
Perylene	< 1.0	
Dibenz[a,h]anthracene	< 0.3	
Dibenzo[def,p]chrysene	< 0.12	
9,10-Dimethylanthracene	< 2.0	*
2-Methylanthracene	< 2.0	*
Benzo[a]fluorene	< 2.0	*
Dibenzo[a,e]pyrene	< 0.18	
Benzo[b]chrysene	< 0.18	
Picene	< 0.6	
p-Quarterphenyl	< 0.2	
Coronene	< 0.18	
Dibenz[a,h]acridine	< 0.08	
Dibenzo[a,h]pyrene	< 0.4	
3-Methylcholanthrene	< 0.04	
2,3-Benzofluorene	< 2.0	*
Benzo[g,h,i]fluoranthene	< 1.0	
Naphtho[1,2,3,4,def]chrysene	< 0.06	

Note: * Indicates data by GC/MS
N.A. indicates interferences in analysis

CAS# 64741-87-3

Naphtha Data Presentation

CLI Log #			DC-1239
API Description.			81-08
API Gravity	D287	@60	76.9
Density	D287	@15 C	.6782
Molecular Weight	D2224	gm/mol	81
Refractive Index		RI units @20 C	1.3892
Total Sulfur	D3120	ppm/wt	1170
Total Nitrogen	Chemil.	ppm/wt	<1
Total Oxygen	NAA	wt %	0.42
Total Chloride	coulom.	ppm/wt	<1
Distillation	D86	vol/deg F	
IBP/5			102/115
10/20			120/124
30/40			129/133
50/60			138/144
70/80			150/159
90/95			170/188
End Point			238
Received			98.0
Residue			1.0
Loss			1.0

Hydrocarbon Type Analysis

Saturates	D1319	vol %		95.9
Olefins	"	"		<0.1
Aromatics	"	"		4.1
			Total	100.0

Mass Spectrometer Analysis (D2789)

Paraffins	D2789/MS	vol %		72.1
Naphthenes	"	"		20.9
Olefins	"	"		<0.1
Aromatics	"	"		6.9
Indans/Tetralins	"	"		0.1
Naphthalenes	"	"		0.0
			Total	100.0

Naphtha Component Analysis by Capilliary GC and GC/MS

CLI Log # DC-1239
API Designation 81-08

Component ID by GC/MS	Component ID by Cap GC	Wt %
Iso-Butane	*	0.07
n-Butane	*	1.13
Neopentane	*	0.01
Iso-Pentane	*	11.01
1-Pentene	*	<0.01
2-Methyl-1-butene	*	<0.01
n-Pentane	*	19.67
trans-2-Pentene	*	0.01
cis-2-Pentene	*	<0.01
2-Methyl-2-butene	*	0.01
2,2-Dimethylbutane	*	0.34
Cyclopentane	*	2.62
2,3-Dimethylbutane	*	1.45
2-Methylpentane	*	11.53
3-Methylpentane	*	7.90
n-Hexane	*	15.71
Methylcyclopentane	*	9.30
2,2-Dimethylpentane	*	0.20
2,4-Dimethylpentane	*	0.01
Benzene	*	5.10
3,3-Dimethylpentane	*	0.01
Cyclohexane	*	5.02
2-Methylhexane	*	1.06
2,3-Dimethylpentane	*	0.54
1,1-Dimethylcyclopentane	*	0.28
3-Methylhexane	*	1.20
cis-1,3-Dimethylcyclopentane	*	0.66
trans-1,3-Dimethylcyclopentane	*	0.51
trans-1,2-Dimethylcyclopentane	*	1.07
n-Heptane	*	1.25
cis-1,2-Dimethylcyclopentane	*	0.05
Methylcyclohexane	fused	1.06
1,1,3-Trimethylcyclopentane	fused	0.02
Ethylcyclopentane	unknown	0.03
2,5-Dimethylhexane	unknown	0.01
1,2,4-Trimethylcyclopentane	fused	0.02
C8 Naphthene	unknown	0.02
Toluene	*	0.63
2,3,4-Trimethylpentane	unknown	0.01

Component ID by GC/MS	Component ID by Cap GC	Wt %
2-Methylheptane	*	0.04
4-Methylheptane	unknown	0.01
3-Methylheptane	*	0.02
1,1-Dimethylcyclohexane	unknown	0.02
trans-1,4-Dimethylcyclohexane	unknown	0.01
C8 Naphthene	unknown	0.01
C8 Naphthene	unknown	0.01
C8 Naphthene	unknown	0.01
1-Methyl-1-ethylcyclopentane	unknown	0.01
1,2,3-Trimethylcyclopentane	unknown	0.01
n-Octane	*	0.16
Naphthene	unknown	0.01
C9 Paraffin	unknown	0.01
C9 Naphthene	unknown	0.01
C9 Naphthene	unknown	0.01
Ethylbenzene	*	0.01
C9 Parraffin	unknown	0.01
p + m Xylene	N.D.	0.01
C9 Paraffin	N.D.	0.01
C9 Paraffin	N.D.	0.01
C9 Paraffin	N.D.	0.01
n-Nonane	*	0.02
C10 Paraffin	N.D.	0.01
	Total	100.00

NOTE: *Indicates capillary GC ID matches that of GC/MS.

Polynuclear Aromatics Data Presentation

CLI Log #	DC-1239
API Designation	81-08

Component	ppm(wt/vol)
Indene	0.03 *
Naphthalene	16 *
1-Methylnaphthalene	5.4
2-Methylnaphthalene	8.0
Acenaphthene	0.035 *
Acenaphthalene	<0.20 *
Fluorene	0.16 *
1,4-Dimethylnaphthalene	0.54 *
Phenanthrene	0.028 *
Fluoranthene	<0.011
Anthracene	<0.02 *
Pyrene	<0.029
Benz[a]anthrancene	<0.020
Chrysene	<0.10
Benzo[b]fluoranthene	<0.002
Benzo[k]fluoranthene	<0.0004
Benz[a]pyrene	<0.003
Benzo[g,h,i]perylene	<0.003
Indeno[1,2,3,c,d]pyrene	<0.003
Perylene	<0.009
Dibenz[a,h]anthracene	<0.005
Dibenzo[def,p]chrysene	<0.002
9,10-Dimethylanthracene	<0.029
2-Methylanthracene	<0.085
Benzo[a]fluorene	<0.047
7,12-Dimethylbenzene[a]anthracene	<0.0012
Dibenzo[a,e]pyrene	<0.003
Benzo[b]chrysene	<0.003
Picene	<0.014
p-Quarterphenyl	<0.005
Coronene	<0.003
Dibenz[a,h]acridine	<0.0013
Dibenzo[a,h]pyrene	<0.007
3-Methylcholanthrene	<0.0008
2,3-Benzofluorene	<0.08
Benzo[g,h,i]fluoranthene	<0.016
Naphtho[1,2,3,4,def]chrysene	<0.0010

NOTE: *Indicates data by GC/MS.

CAS # 68955-35-1

Naphtha Data Presentation

CLI Log #			DC1246
API Description.			83-05
API Gravity	D287	@60	44.2
Density	D287	@15 C	.8045
Molecular Weight	D2224	gm/mol	96
Refractive Index		RI units	1.4592
Total Sulfur	D3120	ppm/wt	<1
Total Nitrogen	Chemil.	ppm/wt	<1
Total Oxygen	NAA	wt %	<0.01
Total Chloride	coulom.	ppm/wt	<1
Distillation	D86	vol/deg F	
IBP/5			136/168
10/20			182/213
30/40			230/245
50/60			259/271
70/80			286/306
90/95			326/351
End Point			392
Received			97.5
Residue			1.0
Loss			1.5

Hydrocarbon Type Analysis

Saturates	D1319	vol %		36.2
Olefins	"	"		0.5
Aromatics	"	"		63.3
			Total	100.0

Mass Spectrometer Analysis (D2789)

Paraffins	D2789/MS	vol %		32.1
Naphthenes	"	"		3.7
Aromatics	"	"		63.3
Indans/Tetralins	"	"		0.7
Naphthalenes	"	"		0.2
			Total	100.0

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log #		DC-1246
API Designation		83-05
Component ID by GC/MS	Component ID by Cap GC	Wt %
n-Butane	*	0.01
Iso-Pentane	*	2.09
1-Pentene	*	0.01
2-Methyl-1-butene	*	0.02
n-Pentane	*	1.79
trans-2-Pentene	*	0.01
cis-2-Pentene	*	0.01
2-Methyl-2-butene	*	0.03
2,2-Dimethylbutane	*	0.30
Cyclopentane	*	0.09
2,3-Dimethylbutane	*	0.39
2-Methylpentane	*	2.13
3-Methylpentane	*	1.68
Hexene-1	*	0.01
n-Hexane	*	2.03
C6 Olefin	unknown	0.01
C6 Olefin	unknown	0.01
cis-2-Hexene	*	0.01
trans-2-Hexene	*	0.01
C6 Olefin	unknown	0.01
C7 Paraffin	fused	0.23
Methylcyclopentane	*	0.43
2,2-Dimethylpentane	*	0.36
2,4-Dimethylpentane	N.D.	0.03
Benzene	*	3.03
3,3-Dimethylpentane	fused	0.24
Cyclohexane	*	0.04
2-Methylhexane	*	2.53
2,3-Dimethylpentane	fused	0.65
1,1-Dimethylcyclopentane	fused	0.08
3-Methylhexane	*	2.93
cis-1,3-Dimethylcyclopentane	unknown	0.10
3-Ethylpentane	*	0.40
trans-1,2-Dimethylcyclopentane	unknown	0.10
n-Heptane	*	2.16
cis-1,2-Dimethylcyclopentane	unknown	0.03
Methylcyclohexane	fused	0.13
2,2-Dimethylhexane	fused	0.02
2,5-Dimethylhexane	fused	0.23
2,4-Dimethylhexane	*	0.38
1,2,4-Trimethylcyclopentane	unknown	0.04

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log #	DC-1246
API Designation	83-05

Component ID by GC/MS	Component ID by Cap GC	Wt %
C8 Naphthene	N.D.	0.01
Toluene	*	19.61
3,3-Dimethylhexane	unknown	0.28
2,3,4-Trimethylpentane	fused	0.04
2-Methylheptane	*	0.92
4-Methylheptane	*	0.46
3,4-Dimethylhexane	*	0.13
3-Methylheptane	*	1.16
3-Methyl-3-ethylpentane	fused	0.26
C8 Naphthene	N.D.	0.02
C8 Paraffin	N.D.	0.01
C8 Naphthene	N.D.	0.02
1-Methyl-1-ethylcyclopentane	N.D.	0.02
1,2,3-Trimethylcyclopentane	N.D.	0.02
n-Octane	*	0.87
2,4,4-Trimethylhexane	N.D.	0.01
2,3,5-Trimethylhexane	N.D.	0.02
2,2-Dimethylheptane	unknown	0.06
2,2-Dimethyl-3-ethylpentane	*	0.05
2,4-Dimethylheptane	unknown	0.17
Ethylbenzene	*	4.45
p + m Xylene	*	16.81
N.D.	3,4-Dimethylheptane	0.10
4-Methyloctane	*	0.24
2-Methyloctane	*	0.23
3-Methyloctane	N.D.	0.06
2,2,4,5-Tetramethylhexane	unknown	0.29
o-Xylene	*	6.03
n-Nonane	*	0.24
Isopropylbenzene	unknown	0.28
n-Propylbenzene	*	1.21
1-Methyl-3-ethylbenzene	*	4.04
1-Methyl-4-ethylbenzene	*	1.79
3,3,4-Trimethylheptane	N.D.	0.01
1-Methyl-2-ethylbenzene	unknown	2.12
C10 Paraffin	N.D.	0.02
C10 Paraffin	N.D.	0.02
1,3,5-Trimethylbenzene	unknown	1.27
C10 Paraffin	N.D.	0.02

Naphtha Component Analysis by Capillary GC and GC/MS

CLI Log #: DC-1246
API Designation: 83-05

Component ID by GC/MS	Component ID by Cap GC	Wt %
1,2,4-Trimethylbenzene	*	6.10
C10 Alkylbenzene	N.D.	0.01
Decane	*	0.04
1,2,3-Trimethylbenzene	*	1.20
Indane	*	0.34
1,3-Diethylbenzene	*	0.21
1-Methyl-3-n-propylbenzene	*	0.60
n-Butylbenzene	unknown	0.46
1,2-Diethylbenzene	unknown	0.60
C10 Alkylbenzene	unknown	0.17
1-Methyl-2-n-propylbenzene	unknown	0.33
1,3-Dimethyl-5-ethylbenzene	unknown	0.31
C10 Alkylbenzene	unknown	0.60
C10 Alkylbenzene	unknown	0.02
C10 Alkylbenzene	unknown	0.31
C10 Alkylbenzene	unknown	0.44
2-Methylindane	N.D.	0.01
1-Methylindane	N.D.	0.02
C10 Alkylbenzene	N.D.	0.02
Naphthalene	N.D.	0.05
	Total	100.00

NOTE: *Indicates capillary GC ID matches that of GC/MS.

Polynuclear Aromatics Data Presentation

CLI Log #	DC-1246
API Designation	83-05

Component	ppm(wt/vol)
Indene	126 *
Naphthalene	2040
1-Methylnaphthalene	670
2-Methylnaphthalene	1190
Acenaphthene	8.3 *
Acenaphthalene	.73 *
Fluorene	32 *
1,4-Dimethylnaphthalene	157 *
Phenanthrene	51 *
Fluoranthene	3.7 *
Anthracene	4.4 *
Pyrene	5.3 *
Benz[a]anthrancene	.63 *#
Chrysene	.86 *#
Benzo[b]fluoranthene	0.66
Benzo[k]fluoranthene	0.095
Benz[a]pyrene	1.2
Benzo[g,h,i]perylene	1.3
Indeno[1,2,3,c,d]pyrene	0.06
Perylene	<.63 *
Dibenz[a,h]anthracene	0.61
Dibenzo[def,p]chrysene	<.69 *
9,10-Dimethylanthracene	2.7 *
2-Methylanthracene	33 *
Benzo[a]fluorene	10.6
7,12-Dimethylbenzene[a]anthracene	4.3 *#
Dibenzo[a,e]pyrene	<0.06
Benzo[b]chrysene	<0.06
Picene	1.5
p-Quarterphenyl	<0.10
Coronene	<0.06
Dibenz[a,h]acridine	<0.074
Dibenzo[a,h]pyrene	10.3 *
3-Methylcholanthrene	<0.023
2,3-Benzofluorene	6.3 *#
Benzo[g,h,i]fluoranthene	24 *#
Naphtho[1,2,3,4,def]chrysene	<0.02

Note: * Indicates data by GC/MS
# Indicates data from ring fraction

HPV High Naphthenic Naphtha Test Material

HUX - Heavy Hydrocrackate from the Hydrocracker Unit.
Where does it come from?

The 3 barrels of HUX or Heavy Hydrocrackate material that was shipped to you (lot #01) begins as crude oil feed to the Crude Unit. Crude oil, which is primarily ANS –Alaska North Slope Crude, is preheated in an exchanger train and desalted in the 1st and 2nd stage desalters. The desalted crude is then sent to a preflash tower to remove some of the lighter components... The crude is again heated and sent to the Crude tower for fractionation. The crude tower separates the crude into fuel gas, naphtha, stove oil, diesel and crude tower bottoms.
The crude tower bottoms are sent to the vacuum heater where they obtain additional heat, then onto the Crude Vacuum unit for further fractionation. This reduced crude is then fractionated under negative pressure into light vacuum gas oil, heavy vacuum gas oil and Vacuum resid.
The Vacuum light and heavy gas oils are now feed to the Hydrocracker Unit.

The Hydrocracker is a combined hydrogenation and Catalytic cracking process. This unit is designed to convert low grade gas oils to high quality gasoline components and middle distillates with a net consumption of Hydrogen.
Feed from the vacuum unit is preheated and sent to a 2 stage reaction tower. Here Nitrogen and sulfur compounds are converted to Ammonia and hydrogen sulfide. The gas oil is then cracked and hydrogenated making jet fuel and lighter.
This cracked fuel is next sent to a 2 stage fractionator where it is separated into debutanizer feed and jet fuel.
The debutanizer feed tower separates it into fuel gas from the top of the tower and splitter feed from the tower bottom.
The debutanizer bottom enters the Splitter tower and is separated into 3 components.
Lux off the top of the tower, Mux from mid tower and Hux from the bottom of the tower.
Hux, the sample which was sent to you, would normally go to the Reformer unit as its feed where it is turned into gasoline blending components.

Sample Characterization of High Naphthenic Naphtha: Chemical Abstract Number Designation

The test material used in studies to characterize mammalian toxicity and biodegradation of hydrocarbons in the Naphthenic (cycloparaffin) blending streams category of the HPV Gasoline Blending Stream Test Plan is a high naphthenic naphtha containing approximately 30% naphthenes. Results of studies with this test material can be used for read-across purposes for all CAS numbers identifying high naphthenic gasoline blending streams containing 19 to 30% or more naphthenic components.

This high naphthenic naphtha is derived from hydrogenation and hydrocracking process steps with removal of nitrogen and sulfur (sweetening) that convert low grade gas oils to higher quality components for direct blending of gasoline. Due to the multiple steps in generating this test material, the supplying refinery identified the sample under the broad CAS #64741-41-9, with the Chemical Abstract name of Naphtha, petroleum, heavy straight run, a CAS number which encompasses the more process-specific designations sweet naphtha and heavy crackate. The refinery further indicated that the sample underwent the hydrocracking HUX process that also makes applicable the more narrowly defined designation heavy hydrocrackate. Finally, the CAS #64741-78-2, with the Chemical Abstract name of Naphtha, petroleum, heavy hydrocracked can and has been used to identify this test material and is descriptive of the hydrocracking step employed.

This test sample identified as CAS #64741-41-9 for chain of custody purposes was collected as a single lot from one refinery and was chemically characterized prior to shipping in 3 drums to the sample repository. Contents of each drum were further analyzed to verify compositional uniformity between drums and distributed to the contract laboratories for testing. CAS #64741-41-9 and the name Naphtha, petroleum, heavy straight run will therefore be used officially to designate the test material.

Sample ID : 2005-003022-DRPK-001

Customer Product Description : ID: 1203-005 Naphtha

Method	Test	Results	Units
ASTM D323 Procedure A	Reid Vapor Pressure	0.00	psi

Initial: pm

Intertek Caleb Brett, 1114 Seaco Avenue, Deer Park TX 77536, Ph: (713) 844-3200, Fax: (713) 844-3330, Email: dptechctr@intertek.com

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Email: dptechctr@intertek.com

Report of Analysis No. 2005-003022-DRPK

SAMPLE DETAILS: Sample(s) received on Thursday, June 2, 2005

SUBMITTED BY: American Petroleum Institute (API)

YOUR REFERENCE:

CUSTOMER PRODUCT DESCRIPTION	SAMPLE ID
ID: 1203-005 Naphtha	2005-003022-DRPK-001

RESULTS: SEE ATTACHED SHEETS

APPROVED BY:

Intertek Caleb Brett

Intertek Caleb Brett

Report of Analysis No. 2005-001447-DRPK

Sample ID : 2005-001447-DRPK-001

Customer Product Description : ID: Highly Naphthenic Naptha

Method	Test	Results	Units
ASTM D1319 (IP 156)	Aromatics	10.1	Vol %
ASTM D1319 (IP 156)	Olefins	0.6	Vol %
ASTM D1319 (IP 156)	Saturates	89.3	Vol %
ASTM D2386	Freezing Point	<-72.0	
ASTM D2386	Freezing Point	<-97.6	°F
ASTM D4052 (IP 365)	API Gravity 15.56°C, 60°F	56.1	°API
ASTM D445 (IP 71S1)	Kinematic Viscosity at 40°C, 104°F	0.6433	cSt
ASTM D4629 (IP 379)	Nitrogen	0.6	ppm (mg / kg)
ASTM D5191-EPA	Dry Vapor Pressure Equivalent	1.43	psi
ASTM D5191-EPA	Sample	Normal	
ASTM D5443	Iso-Paraffins	28.52	Vol %
ASTM D5443	n-Paraffins	19.88	Vol %
ASTM D5443	Olefins	0.67	Vol %
ASTM D5443	Naphthenes	39.59	Vol %
ASTM D5443	Aromatics	11.12	Vol %
ASTM D5443	> 200 °C (Non Aromatic)	0.22	Vol %
ASTM D5453	Sulfur	2.1	ppm (µg / g)
ASTM D6730	Paraffins	20.33	Vol %
ASTM D6730	Iso-Paraffins	31.68	Vol %
ASTM D6730	Olefins	1.86	Vol %
ASTM D6730	Naphthenes	32.32	Vol %
ASTM D6730	Aromatics	12.25	Vol %
ASTM D6730	C14+	<0.01	Vol %
ASTM D6730	Unknowns	1.56	Vol %
ASTM D6730	N+A	44.57	Vol %
ASTM D6730	Molecular Weight	112.25	
ASTM D86	Initial Boiling Point	209.8	°F
ASTM D86	5% Recovery	225.9	°F
ASTM D86	10% Recovery	229.0	°F
ASTM D86	20% Recovery	233.5	°F
ASTM D86	30% Recovery	238.4	°F
ASTM D86	40% Recovery	244.8	°F
ASTM D86	50% Recovery	251.7	°F
ASTM D86	60% Recovery	260.7	°F

Initial: AM

Intertek Caleb Brett, 1114 Seaco Avenue, Deer Park TX 77536, Ph: (713) 844-3200, Fax: (713) 844-3330, Email: dptechctr@intertek.com

Sample ID : 2005-001447-DRPK-001

Customer Product Description : ID: Highly Naphthenic Naptha

Method	Test	Results	Units
ASTM D86	70% Recovery	272.1	°F
ASTM D86	80% Recovery	285.5	°F
ASTM D86	90% Recovery	303.1	°F
ASTM D86	95% Recovery	315.9	°F
ASTM D86	Final Boiling Point	352.2	°F
ASTM D86	% Recovered	100.0	Vol %
ASTM D86	% Residue	0.0	Vol %
ASTM D86	% Loss	0.0	Vol %

Initial: PM

Intertek Caleb Brett
1114 Seaco Avenue
Deer Park, TX 77536
Ph: (713) 844 3200
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Email: dptechctr@intertek.com

Report of Analysis No. 2005-001447-DRPK

SAMPLE DETAILS: Sample(s) received on Tuesday, March 22, 2005

SUBMITTED BY: API, Regulatory Affairs and Scientific Affairs

CUSTOMER PRODUCT DESCRIPTION
ID: Highly Naphthenic Naptha

SAMPLE ID
2005-001447-DRPK-001

RESULTS: SEE ATTACHED SHEETS

APPROVED BY:

Intertek Caleb Brett

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Summary by Group

Group	%Wgt	%Vol	%Mol
Aromatics	13.742	11.795	14.415
I-Paraffins	31.192	32.830	29.885
Naphthenes	29.548	28.574	31.154
Olefins	4.963	5.091	4.502
Paraffin	18.858	20.051	18.615
Oxygenates	0.000	0.000	0.000
Unidentified	1.696	1.660	1.430
Plus	0.000	0.000	0.000

ASTM METHOD
D - 6729
CGSB - Detailed Hydrocarbon Analysis

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Composite by Carbon

Group	C#	%Wgt	%Vol	%Mol
Aromatics	C6	0.109	0.093	0.157
	C7	3.707	3.191	4.510
	C8	4.912	4.223	5.186
	C9	3.881	3.315	3.623
	C10	1.033	0.888	0.863
	C11	0.099	0.085	0.076
I-Paraffins	C6	0.159	0.179	0.206
	C7	7.875	8.611	8.809
	C8	9.781	10.344	9.598
	C9	8.771	9.039	7.664
	C10	4.020	4.079	3.167
	C11	0.578	0.569	0.435
	C12	0.009	0.009	0.006
Naphthenes	C6	1.183	1.159	1.575
	C7	12.754	12.483	14.561
	C8	11.109	10.699	11.100
	C9	3.605	3.396	3.201
	C10	0.897	0.837	0.717
Olefins	C7	0.200	0.210	0.201
	C8	0.860	0.896	0.859
	C9	3.629	3.709	3.223
	C10	0.274	0.277	0.219
Paraffin	C6	0.183	0.207	0.239
	C7	6.727	7.339	7.525
	C8	5.571	5.913	5.466
	C9	4.325	4.495	3.780
	C10	1.893	1.935	1.491
	C11	0.154	0.155	0.110
	C12	0.005	0.005	0.003

Recovery = 100.00

F... C:\HPCHEM\HCE30\DATA\ANALYSIS\...
Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
1	27.947	I6	64 2,3-Dimethylbutane	0.008	0.009	0.010
2	29.002	I6	74 2-Methylpentane	0.065	0.075	0.085
3	31.636	I6	80 3-Methylpentane	0.086	0.096	0.111
4	35.357	P6	96 n-Hexane	0.183	0.207	0.239
5	40.146	N6	112 McyC5+2,2DMC5	0.679	0.676	0.904
6	41.766	I7	116 2,4-Dimethylpentane	0.143	0.158	0.160
7	45.127	A6	130 Benzene	0.109	0.093	0.157
8	46.727	I7	134 33DMC5+5m1C6ene	0.046	0.050	0.052
9	46.992	N6	136 Cyclohexane	0.504	0.483	0.671
10	50.190	I7	156 2-MethylC6 + C7-Olefin	4.159	4.571	4.652
11	52.019	I7	166 3-Methylhexane	3.284	3.572	3.673
12	52.814	N7	172 t-1,3-DimethylcyC5	1.487	1.472	1.698
13	53.391	N7	174 c-1,3-DMcyclopentane	1.349	1.344	1.540
14	54.007	N7	176 t-1,2-DimethylcycloC5	1.632	1.621	1.863
15	54.168	I7	180 3-Ethylpentane	0.244	0.260	0.273
16	54.624	I8	186 2,2,4-Trimethylpentane	0.040	0.043	0.039
17	55.001	O7	189 C7-Olefin	0.008	0.008	0.009
18	57.634	P7	200 n-Heptane	6.727	7.339	7.525
19	60.995	N7	222 Methylcyclohexane	7.067	6.858	8.068
20	61.881	N8	224 1,1,3-TrimethylcycloC5	0.486	0.485	0.485
21	62.330	I8	226 2,2-Dimethylhexane	0.062	0.066	0.061
22	63.709	N7	234 Ethylcyclopentane	1.219	1.188	1.392
23	64.404	I8	240 2,2,3-Trimethylpentane	0.011	0.012	0.011
24	64.637	I8	245 2,5-DMC6 + C8-olefin	0.504	0.539	0.494
25	64.970	I8	250 2,4-Dimethylhexane	0.594	0.633	0.583
26	65.777	N8	260 t,c-1,2,4-TriMcyC5	0.949	0.948	0.948
27	66.207	I8	265 3,3-DMC6 + C8-olefin	0.078	0.081	0.076
28	67.294	N8	278 t,c-1,2,3-TriMcycloC5	0.659	0.653	0.658
29	67.933	I8	292 2,3,4-Trimethylpentane	0.067	0.069	0.065
30	68.463	A7	300 Toluene	3.707	3.191	4.510
31	69.951	O8	312 C8-Olefin	0.198	0.207	0.197
32	70.283	I8	314 2,3-Dimethylhexane	0.397	0.416	0.390
33	70.428	I8	316 2-M-3-Epentane	0.159	0.166	0.157
34	71.621	I8	326 2-Methylheptane	3.088	3.301	3.030
35	71.845	I8	328 4-Methylheptane	1.026	1.062	1.007
36	72.065	O7	330 C7-Diolefin + C8-Olefin	0.192	0.202	0.192
37	72.188	O8	333 C8-Olefins	0.162	0.170	0.162
38	72.706	N8	335 t-1,4-DiMcycloC6	1.968	1.866	1.967
39	72.903	I8	336 3-Methylheptane	2.529	2.673	2.482

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
40	73.052	I8	338 3-Ethylhexane	1.226	1.281	1.203
41	73.918	O8	348 C8-Olefin	0.252	0.263	0.251
42	74.737	N8	352 c1Ethyl-3-methylcyC5	0.814	0.788	0.813
43	75.091	N8	356 t-1-E-3-McyC5	0.749	0.727	0.748
44	75.307	N8	360 t-1-E-2-McyC5	0.715	0.691	0.714
45	75.575	N8	362 1-M-1-EcycloC5	0.077	0.073	0.077
46	75.992	N3	368 t-1,2-DiMcycloC6	0.872	0.839	0.871
47	76.945	N8	385 t-1,3-DiMcycloC6	0.070	0.067	0.070
48	77.232	N8	390 c-1,4-DiMcycloC6	1.317	1.262	1.316
49	77.480	P8	400 n-Octane	5.571	5.913	5.466
50	78.324	O9	410 C9-Olefin	0.173	0.179	0.153
51	78.461	O9	412 C9-Olefin	0.117	0.121	0.104
52	79.045	I9	418 2,2,4-Trimethylhexane	0.024	0.025	0.021
53	79.375	?	Unidentified	0.053	0.055	0.046
54	79.913	I9	424 2,3,5-Trimethylhexane	0.049	0.051	0.043
55	79.980	O8	426 cis-2-Octene	0.249	0.256	0.248
56	80.445	I9	428 2,2,3,4-TetraMC5	0.056	0.057	0.049
57	80.823	N8	432 c-1,2-DiMcycloC6	0.339	0.316	0.339
58	81.055	I9	434 2,4-Dimethylheptane	0.420	0.439	0.367
59	81.333	O9	436 C9-Olefin	0.070	0.072	0.062
60	81.647	N8	440 Ethylcyclohexane	2.095	1.984	2.093
61	81.862	I9	444 2-Methyl-4-Ethylhexane	0.056	0.058	0.049
62	82.017	I9	446 2,6-Dimethylheptane	0.829	0.859	0.724
63	82.179	O9	449 C9-Olefin	0.131	0.135	0.117
64	82.450	O9	452 C9-Olefins	0.941	0.967	0.836
65	82.793	O9	454 C9-Olefins	0.171	0.176	0.152
66	82.940	I9	458 2,5 & 3,5-DMheptane	0.718	0.739	0.628
67	83.106	O9	460 C9-Olefins	0.122	0.126	0.109
68	83.230	I9	462 3,3-Dimethylheptane	0.207	0.214	0.181
69	83.405	?	Unidentified	0.332	0.344	0.290
70	83.633	I9	466 C9-Isoparaffin	0.218	0.223	0.190
71	84.220	A8	475 Ethylbenzene	1.024	0.882	1.082
72	84.401	N9	480 t-1,2,4-TrimethylcyC6	0.352	0.336	0.312
73	84.624	I9	485 2,3,4-Trimethylhexane	0.625	0.631	0.546
74	84.885	O9	490 C9-Olefins	0.087	0.089	0.077
75	85.163	I9	495 3,3,4-Trimethylhexane?	0.153	0.153	0.134
76	85.445	A8	500 m-Xylene	2.000	1.728	2.112
77	85.583	A8	502 p-Xylene	0.710	0.615	0.749
78	85.750	I9	503 2,3-Dimethylheptane	0.518	0.530	0.453

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
79	85.998	I9	506 3,4-Dimethylheptane	0.064	0.066	0.056
80	86.133	?	Unidentified	0.067	0.069	0.060
81	86.189	O9	508 C9-Olefin	0.150	0.154	0.134
82	86.387	I9	510 3-Methyl-3-ethylhexane	0.246	0.248	0.215
83	86.552	I9	516 4-Ethylheptane	0.101	0.104	0.089
84	86.814	I9	518 4-MC8+C9-Olefin	0.884	0.916	0.773
85	86.954	I9	520 2-Methyloctane	1.215	1.275	1.061
86	87.260	?	Unidentified	0.033	0.035	0.029
87	87.318	I9	524 C9-Isoparaffin	0.139	0.144	0.122
88	87.644	I9	528 3-Ethylheptane	0.371	0.379	0.324
89	87.814	I9	530 3-Methyloctane	1.431	1.473	1.250
90	87.888	O9	535 C9-Olefin	0.137	0.139	0.121
91	88.061	N9	540 c-1,2,4-TriMcyC6	0.092	0.088	0.082
92	88.310	N9	545 1,1,2-TriMcycloC6	0.149	0.145	0.132
93	88.407	A8	550 o-Xylene	1.178	0.999	1.243
94	88.539	O9	560 C9-Olefin	0.089	0.090	0.079
95	88.658	O9	562 C9-Olefin	0.151	0.154	0.134
96	88.869	O9	564 C9-Olefin	0.021	0.021	0.018
97	88.945	?	Unidentified	0.021	0.021	0.019
98	89.236	N9	568 t-1-E-4-M-cyC6?	0.532	0.498	0.473
99	89.390	N9	570 c-1-E-4-McyC6?	0.820	0.767	0.728
100	89.684	I9	572 C9-Isoparaffin	0.427	0.435	0.373
101	90.006	O9	575 1-Nonene	0.099	0.101	0.088
102	90.177	N9	580 Isobutylcyclopentane	0.146	0.139	0.130
103	90.262	?	Unidentified	0.069	0.066	0.062
104	90.329	?	Unidentified	0.015	0.015	0.014
105	90.965	O9	590 cis-3-Nonene	0.066	0.067	0.058
106	91.096	I9	595 C9-Isoparaffin	0.019	0.019	0.016
107	91.328	P9	600 n-Nonane	4.325	4.495	3.780
108	91.746	O9	604 trans-2-Nonene	0.511	0.516	0.453
109	92.094	N9	606 1-M-1-Ecyclohexane	0.170	0.157	0.151
110	92.300	N9	608 1-M-2-PcycloC5	0.017	0.016	0.015
111	92.577	A9	616 Isopropylbenzene	0.130	0.113	0.122
112	92.830	O9	618 cis-2-Nonene	0.029	0.030	0.026
113	92.901	N9	620 tert-Butylcyclopentane	0.117	0.111	0.104
114	93.051	O9	622 C9-Olefins	0.316	0.320	0.281
115	93.288	O9	624 C9-Olefin	0.249	0.252	0.221
116	93.563	N9	626 Isopropylcyclohexane	0.229	0.213	0.204
117	93.819	I10	630 2,2-Dimethyloctane	0.128	0.131	0.101

Recovery = 100.00

Sample: HUX Tank 31
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Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
118	93.970	?	Unidentified	0.021	0.021	0.016
119	94.069	?	Unidentified	0.016	0.017	0.013
120	94.290	?	Unidentified	0.102	0.096	0.082
121	94.370	N10	634 1-M-4-isopropylcyC6?	0.247	0.232	0.197
122	94.520	N9	636 sec-Butylcyclopentane	0.567	0.536	0.503
123	94.694	I10	638 2,6-Dimethyloctane	0.097	0.100	0.077
124	94.847	I10	640 2,5-Dimethyloctane?	0.109	0.110	0.086
125	94.956	N9	642 Butylcyclopentane	0.310	0.294	0.275
126	95.143	?	Unidentified	0.099	0.093	0.088
127	95.399	I10	646 3,6-Dimethyloctane	0.730	0.737	0.575
128	95.546	N9	648 1-M-2-EcycloC6	0.104	0.095	0.092
129	95.694	?	Unidentified	0.054	0.050	0.048
130	95.825	O10	650 C10-Olefin	0.133	0.134	0.107
131	96.014	A9	651 Propylbenzene	0.470	0.407	0.438
132	96.232	I10	652 3,6-Dimethyloctane	0.449	0.455	0.354
133	96.471	I10	653 3-Methyl-5-ethylheptane	0.074	0.074	0.058
134	96.607	O10	654 C10-Olefin	0.100	0.101	0.080
135	96.860	A9	655 1-Ethyl-3-methylbenzene	0.733	0.632	0.683
136	97.093	A9	656 1-Ethyl-4-methylbenzene	0.417	0.362	0.389
137	97.276	?	Unidentified	0.026	0.023	0.024
138	97.623	N10	657 C10-Naphthene	0.081	0.076	0.065
139	97.703	A9	658 1,3,5-Trimethylbenzene	0.604	0.521	0.564
140	97.974	I10	659 2,3-Dimethyloctane	0.055	0.055	0.043
141	98.115	?	Unidentified	0.074	0.075	0.058
142	98.212	I10	660 5-Methylnonane	0.231	0.235	0.182
143	98.402	I10	661 4-Methylnonane	0.556	0.563	0.438
144	98.676	I10	662 2-Methylnonane	0.492	0.504	0.387
145	98.783	A9	663 1-Ethyl-2-methylbenzene	0.332	0.280	0.309
146	99.047	N10	666 C10-Naphthene	0.148	0.136	0.118
147	99.231	?	Unidentified	0.025	0.025	0.020
148	99.375	I10	668 3-Methylnonane	0.480	0.489	0.378
149	99.533	?	Unidentified	0.081	0.081	0.065
150	99.554	?	Unidentified	0.093	0.093	0.074
151	99.705	O10	670 C10-Olefin	0.041	0.042	0.033
152	99.854	?	Unidentified	0.118	0.120	0.093
153	100.159	I10	672 C10-Isoparaffin	0.051	0.052	0.040
154	100.404	A9	673 1,2,4-Trimethylbenzene	0.750	0.639	0.700
155	100.579	?	Unidentified	0.156	0.133	0.145
156	100.749	I10	674 C10-Isoparaffin	0.202	0.205	0.159

Recovery = 100.00

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Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
157	100.899	I10	675 C10-Isoparaffin	0.176	0.179	0.138
158	101.052	I10	676 Isobutylcyclohexane	0.075	0.070	0.059
159	101.239	?	Unidentified	0.019	0.020	0.016
160	101.342	N10	677 C10-Isoparaffin	0.071	0.072	0.057
161	101.492	I10	678 C10-Isoparaffin	0.031	0.032	0.025
162	101.616	I10	682 C10-Isoparaffin	0.009	0.009	0.007
163	101.815	A10	690 Isobutylbenzene	0.046	0.040	0.039
164	102.017	I10	694 C10-Isoparaffin	0.077	0.078	0.061
165	102.309	P10	700 n-Decane	1.893	1.935	1.491
166	102.602	I11	702 C11-Isoparaffin	0.019	0.019	0.013
167	102.817	?	Unidentified	0.033	0.034	0.024
168	103.062	I11	704 C11-Isoparaffin	0.025	0.025	0.018
169	103.257	A9	705 1,2,3-Trimethylbenzene	0.276	0.230	0.257
170	103.454	?	Unidentified	0.020	0.017	0.017
171	103.531	A10	706 1-M-3-isopropylbenzene	0.016	0.014	0.014
172	103.688	A10	708 1-M-4-isopropylbenzene	0.039	0.034	0.033
173	103.871	I11	709 C11-Isoparaffin	0.085	0.086	0.061
174	104.089	I11	710 C11-Isoparaffin?	0.012	0.012	0.009
175	104.280	?	Unidentified	0.016	0.012	0.015
176	104.426	A9	712 2,3-Dihydroindene	0.169	0.131	0.160
177	104.724	N10	714 sec-Butylcyclohexane	0.238	0.218	0.191
178	104.804	?	Unidentified	0.036	0.037	0.026
179	104.992	?	Unidentified	0.008	0.007	0.007
180	105.219	I11	720 3-Ethylnonane	0.061	0.062	0.044
181	105.330	I11	721 C11-Isoparaffin	0.038	0.039	0.028
182	105.484	N10	722 C10-Naphthene	0.112	0.103	0.089
183	105.802	I11	723 C11-Isoparaffin	0.122	0.122	0.109
184	105.990	A10	724 1,3-Diethylbenzene	0.051	0.044	0.043
185	106.244	A10	725 1-M-3-propylbenzene	0.197	0.170	0.164
186	106.432	A10	726 1,4-Diethylbenzene	0.019	0.016	0.016
187	106.604	A10	727 1-M-4-propylbenzene	0.059	0.051	0.049
188	106.710	A10	728 Butylbenzene	0.061	0.053	0.051
189	106.836	A10	729 3,5-DM-1-Ebenzene	0.067	0.058	0.056
190	106.996	?	Unidentified	0.029	0.025	0.024
191	107.116	A10	730 1,2-Diethylbenzene?	0.029	0.025	0.024
192	107.371	I11	732 C11-Isoparaffin	0.031	0.031	0.022
193	107.560	A10	736 C10-Aromatic	0.033	0.028	0.028
194	107.670	A10	738 C10-Aromatic	0.087	0.075	0.073
195	107.823	A10	740 1-M-2-propyl benzene	0.064	0.054	0.053

Recovery = 100.00

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Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
196	107.977	?	Unidentified	0.005	0.005	0.004
197	108.091	I11	748 4-Methyldecane	0.059	0.055	0.042
198	108.392	I11	754 C11-Isoparaffin	0.065	0.061	0.047
199	108.528	A10	756 1,4-DM-2-Ebenzene	0.059	0.050	0.049
200	108.691	A10	758 1,3-DM-4-Ebenzene	0.053	0.045	0.044
201	108.819	I11	762 3-Methyldecane	0.016	0.016	0.011
202	108.938	?	Unidentified	0.058	0.058	0.042
203	109.198	A10	764 1,2-DM-4-Ebenz+C1indan	0.068	0.058	0.057
204	109.391	I11	766 C11-Isoparaffin	0.010	0.010	0.007
205	109.747	A10	768 1,3-DM-2-Ebenzene	0.029	0.024	0.024
206	109.880	?	Unidentified	0.006	0.005	0.005
207	110.001	?	Unidentified	0.008	0.008	0.006
208	110.178	I11	770 C11-Isoparaffin	0.018	0.017	0.013
209	110.511	I11	775 C11-Isoparaffin	0.015	0.014	0.011
210	110.732	A11	780 1-M-4-tert-butylbenzene	0.021	0.018	0.016
211	110.857	A10	785 1,2-DM-3-ethylbenzene	0.024	0.020	0.020
212	111.189	P11	800 n-Undecane	0.154	0.155	0.110
213	111.367	A11	802 1-E-4-isopropylbenzene	0.020	0.018	0.015
214	111.800	A10	806 1,2,4,5-TetraMbenzene	0.011	0.009	0.009
215	112.062	A10	810 1,2,3,5-TetraMbenzene	0.020	0.017	0.017
216	112.402	I12	812 C12-Isoparaffin	0.009	0.009	0.006
217	112.634	A11	816 C11-Aromatic	0.009	0.007	0.006
218	113.375	A11	826 1-Ethyl-2-propylbenzene	0.012	0.010	0.009
219	113.916	A11	832 C11-Aromatic	0.004	0.004	0.003
220	114.126	A11	834 1-Methyl-3-butylbenzene	0.012	0.010	0.009
221	114.386	A11	836 1,2,3,4-TetraMbz+C11aro	0.010	0.009	0.009
222	114.894	A11	842 C11-Aromatic	0.011	0.009	0.008
223	117.920	P12	895 n-Dodecane	0.005	0.005	0.003

Recovery = 100.00

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Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
Aromatics	45.127	130	Benzene	0.109	0.093	0.157
	68.463	300	Toluene	3.707	3.191	4.510
	84.220	475	Ethylbenzene	1.024	0.882	1.082
	85.445	500	m-Xylene	2.000	1.728	2.112
	85.583	502	p-Xylene	0.710	0.615	0.749
	88.407	550	o-Xylene	1.178	0.999	1.243
	92.577	616	Isopropylbenzene	0.130	0.113	0.122
	96.014	651	Propylbenzene	0.470	0.407	0.438
	96.860	655	1-Ethyl-3-methylbenzene	0.733	0.632	0.683
	97.093	656	1-Ethyl-4-methylbenzene	0.417	0.362	0.389
	97.703	658	1,3,5-Trimethylbenzene	0.604	0.521	0.564
	98.783	663	1-Ethyl-2-methylbenzene	0.332	0.280	0.309
	100.404	673	1,2,4-Trimethylbenzene	0.750	0.639	0.700
	101.815	690	Isobutylbenzene	0.046	0.040	0.039
	103.257	705	1,2,3-Trimethylbenzene	0.276	0.230	0.257
	103.531	706	1-M-3-isopropylbenzene	0.016	0.014	0.014
	103.688	708	1-M-4-isopropylbenzene	0.039	0.034	0.033
	104.426	712	2,3-Dihydroindene	0.169	0.131	0.160
	105.990	724	1,3-Diethylbenzene	0.051	0.044	0.043
	106.244	725	1-M-3-propylbenzene	0.197	0.170	0.164
	106.432	726	1,4-Diethylbenzene	0.019	0.016	0.016
	106.604	727	1-M-4-propylbenzene	0.059	0.051	0.049
	106.710	728	Butylbenzene	0.061	0.053	0.051
	106.836	729	3,5-DM-1-Ebenzene	0.067	0.058	0.056
	107.116	730	1,2-Diethylbenzene?	0.029	0.025	0.024
	107.560	736	C10-Aromatic	0.033	0.028	0.028
	107.670	738	C10-Aromatic	0.087	0.075	0.073
	107.823	740	1-M-2-propyl benzene	0.064	0.054	0.053
	108.528	756	1,4-DM-2-Ebenzene	0.059	0.050	0.049
	108.691	758	1,3-DM-4-Ebenzene	0.053	0.045	0.044
	109.198	764	1,2-DM-4-Ebenz+C1indan	0.068	0.058	0.057
	109.747	768	1,3-DM-2-Ebenzene	0.029	0.024	0.024
	110.732	780	1-M-4-tert-butylbenzene	0.021	0.018	0.016
	110.857	785	1,2-DM-3-ethylbenzene	0.024	0.020	0.020
	111.367	802	1-E-4-isopropylbenzene	0.020	0.018	0.015
	111.800	806	1,2,4,5-TetraMbenzene	0.011	0.009	0.009
	112.062	810	1,2,3,5-TetraMbenzene	0.020	0.017	0.017
	112.634	816	C11-Aromatic	0.009	0.007	0.006
	113.375	826	1-Ethyl-2-propylbenzene	0.012	0.010	0.009
	113.916	832	C11-Aromatic	0.004	0.004	0.003
	114.126	834	1-Methyl-3-butylbenzene	0.012	0.010	0.009
	114.386	836	1,2,3,4-TetraMbz+C11aro	0.010	0.009	0.009

Recovery = 100.00

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Components by Group

Group	Time	Component	%Wgt	%Vol	%Mol
Aromatics	114.894	842 C11-Aromatic	0.011	0.009	0.008
I-Paraffins	27.947	64 2,3-Dimethylbutane	0.008	0.009	0.010
	29.002	74 2-Methylpentane	0.065	0.075	0.085
	31.636	80 3-Methylpentane	0.086	0.096	0.111
	41.766	116 2,4-Dimethylpentane	0.143	0.158	0.160
	46.727	134 33DMC5+5m1C6ene	0.046	0.050	0.052
	50.190	156 2-MethylC6 + C7-Olefin	4.159	4.571	4.652
	52.019	166 3-Methylhexane	3.284	3.572	3.673
	54.168	180 3-Ethylpentane	0.244	0.260	0.273
	54.624	186 2,2,4-Trimethylpentane	0.040	0.043	0.039
	62.330	226 2,2-Dimethylhexane	0.062	0.066	0.061
	64.404	240 2,2,3-Trimethylpentane	0.011	0.012	0.011
	64.637	245 2,5-DMC6 + C8-olefin	0.504	0.539	0.494
	64.970	250 2,4-Dimethylhexane	0.594	0.633	0.583
	66.207	265 3,3-DMC6 + C8-olefin	0.078	0.081	0.076
	67.933	292 2,3,4-Trimethylpentane	0.067	0.069	0.065
	70.283	314 2,3-Dimethylhexane	0.397	0.416	0.390
	70.428	316 2-M-3-Epentane	0.159	0.166	0.157
	71.621	326 2-Methylheptane	3.088	3.301	3.030
	71.845	328 4-Methylheptane	1.026	1.062	1.007
	72.903	336 3-Methylheptane	2.529	2.673	2.482
	73.052	338 3-Ethylhexane	1.226	1.281	1.203
	79.045	418 2,2,4-Trimethylhexane	0.024	0.025	0.021
	79.913	424 2,3,5-Trimethylhexane	0.049	0.051	0.043
	80.445	428 2,2,3,4-TetraMC5	0.056	0.057	0.049
	81.055	434 2,4-Dimethylheptane	0.420	0.439	0.367
	81.862	444 2-Methyl-4-Ethylhexane	0.056	0.058	0.049
	82.017	446 2,6-Dimethylheptane	0.829	0.859	0.724
	82.940	458 2,5 & 3,5-DMheptane	0.718	0.739	0.628
	83.230	462 3,3-Dimethylheptane	0.207	0.214	0.181
	83.633	466 C9-Isoparaffin	0.218	0.223	0.190
	84.624	485 2,3,4-Trimethylhexane	0.625	0.631	0.546
	85.163	495 3,3,4-Trimethylhexane?	0.153	0.153	0.134
	85.750	503 2,3-Dimethylheptane	0.518	0.530	0.453
	85.998	506 3,4-Dimethylheptane	0.064	0.066	0.056
	86.387	510 3-Methyl-3-ethylhexane	0.246	0.248	0.215
	86.552	516 4-Ethylheptane	0.101	0.104	0.089
	86.814	518 4-MC8+C9-Olefin	0.884	0.916	0.773
	86.954	520 2-Methyloctane	1.215	1.275	1.061
	87.318	524 C9-Isoparaffin	0.139	0.144	0.122
	87.644	528 3-Ethylheptane	0.371	0.379	0.324

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

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Operator:

Components by Group

Group	Time	Component		%Wgt	%Vol	%Mol
I-Paraffins	87.814	530	3-Methyloctane	1.431	1.473	1.250
	89.684	572	C9-Isoparaffin	0.427	0.435	0.373
	91.096	595	C9-Isoparaffin	0.019	0.019	0.016
	93.819	630	2,2-Dimethyloctane	0.128	0.131	0.101
	94.694	638	2,6-Dimethyloctane	0.097	0.100	0.077
	94.847	640	2,5-Dimethyloctane?	0.109	0.110	0.086
	95.399	646	3,6-Dimethyloctane	0.730	0.737	0.575
	96.232	652	3,6-Dimethyloctane	0.449	0.455	0.354
	96.471	653	3-Methyl-5-ethylheptane	0.074	0.074	0.058
	97.974	659	2,3-Dimethyloctane	0.055	0.055	0.043
	98.212	660	5-Methylnonane	0.231	0.235	0.182
	98.402	661	4-Methylnonane	0.556	0.563	0.438
	98.676	662	2-Methylnonane	0.492	0.504	0.387
	99.375	668	3-Methylnonane	0.480	0.489	0.378
	100.159	672	C10-Isoparaffin	0.051	0.052	0.040
	100.749	674	C10-Isoparaffin	0.202	0.205	0.159
	100.899	675	C10-Isoparaffin	0.176	0.179	0.138
	101.052	676	Isobutylcyclohexane	0.075	0.070	0.059
	101.492	678	C10-Isoparaffin	0.031	0.032	0.025
	101.616	682	C10-Isoparaffin	0.009	0.009	0.007
	102.017	694	C10-Isoparaffin	0.077	0.078	0.061
	102.602	702	C11-Isoparaffin	0.019	0.019	0.013
	103.062	704	C11-Isoparaffin	0.025	0.025	0.018
	103.871	709	C11-Isoparaffin	0.085	0.086	0.061
	104.089	710	C11-Isoparaffin?	0.012	0.012	0.009
	105.219	720	3-Ethylnonane	0.061	0.062	0.044
	105.330	721	C11-Isoparaffin	0.038	0.039	0.028
	105.802	723	C11-Isoparaffin	0.122	0.122	0.109
	107.371	732	C11-Isoparaffin	0.031	0.031	0.022
	108.091	748	4-Methyldecane	0.059	0.055	0.042
	108.392	754	C11-Isoparaffin	0.065	0.061	0.047
	108.819	762	3-Methyldecane	0.016	0.016	0.011
	109.391	766	C11-Isoparaffin	0.010	0.010	0.007
	110.178	770	C11-Isoparaffin	0.018	0.017	0.013
	110.511	775	C11-Isoparaffin	0.015	0.014	0.011
	112.402	812	C12-Isoparaffin	0.009	0.009	0.006
Naphthenes	40.146	112	McyC5+2,2DMC5	0.679	0.676	0.904
	46.992	136	Cyclohexane	0.504	0.483	0.671
	52.814	172	t-1,3-DimethylcyC5	1.487	1.472	1.698
	53.391	174	c-1,3-DMcyclopentane	1.349	1.344	1.540
	54.007	176	t-1,2-DimethylcycloC5	1.632	1.621	1.863

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
Naphthenes	60.995	222	Methylcyclohexane	7.067	6.858	8.068
	61.881	224	1,1,3-TrimethylcycloC5	0.486	0.485	0.485
	63.709	234	Ethylcyclopentane	1.219	1.188	1.392
	65.777	260	t,c-1,2,4-TriMcyC5	0.949	0.948	0.948
	67.294	278	t,c-1,2,3-TriMcycloC5	0.659	0.653	0.658
	72.706	335	t-1,4-DiMcycloC6	1.968	1.866	1.967
	74.737	352	c1Ethyl-3-methylcyC5	0.814	0.788	0.813
	75.091	356	t-1-E-3-McyC5	0.749	0.727	0.748
	75.307	360	t-1-E-2-McyC5	0.715	0.691	0.714
	75.575	362	1-M-1-EcycloC5	0.077	0.073	0.077
	75.992	368	t-1,2-DiMcycloC6	0.872	0.839	0.871
	76.945	385	t-1,3-DiMcycloC6	0.070	0.067	0.070
	77.232	390	c-1,4-DiMcycloC6	1.317	1.262	1.316
	80.823	432	c-1,2-DiMcycloC6	0.339	0.316	0.339
	81.647	440	Ethylcyclohexane	2.095	1.984	2.093
	84.401	480	t-1,2,4-TrimethylcyC6	0.352	0.336	0.312
	88.061	540	c-1,2,4-TriMcyC6	0.092	0.088	0.082
	88.310	545	1,1,2-TriMcycloC6	0.149	0.145	0.132
	89.236	568	t-1-E-4-M-cyC6?	0.532	0.498	0.473
	89.390	570	c-1-E-4-McyC6?	0.820	0.767	0.728
	90.177	580	Isobutylcyclopentane	0.146	0.139	0.130
	92.094	606	1-M-1-Ecyclohexane	0.170	0.157	0.151
	92.300	608	1 -M-2-PcycloC5	0.017	0.016	0.015
	92.901	620	tert-Butylcyclopentane	0.117	0.111	0.104
	93.563	626	Isopropylcyclohexane	0.229	0.213	0.204
	94.370	634	1-M-4-isopropylcyC6?	0.247	0.232	0.197
	94.520	636	sec-Butylcyclopentane	0.567	0.536	0.503
	94.956	642	Butylcyclopentane	0.310	0.294	0.275
	95.546	648	1-M-2-EcycloC6	0.104	0.095	0.092
	97.623	657	C10-Naphthene	0.081	0.076	0.065
	99.047	666	C10-Naphthene	0.148	0.136	0.118
	101.342	677	C10-Isoparaffin	0.071	0.072	0.057
	104.724	714	sec-Butylcyclohexane	0.238	0.218	0.191
	105.484	722	C10-Naphthene	0.112	0.103	0.089
Olefins	55.001	189	C7-Olefin	0.008	0.008	0.009
	69.951	312	C8-Olefin	0.198	0.207	0.197
	72.065	330	C7-Diolefin + C8-Olefin	0.192	0.202	0.192
	72.188	333	C8-Olefins	0.162	0.170	0.162
	73.918	348	C8-Olefin	0.252	0.263	0.251
	78.324	410	C9-Olefin	0.173	0.179	0.153
	78.461	412	C9-Olefin	0.117	0.121	0.104

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
Olefins	79.980	426	cis-2-Octene	0.249	0.256	0.248
	81.333	436	C9-Olefin	0.070	0.072	0.062
	82.179	449	C9-Olefin	0.131	0.135	0.117
	82.450	452	C9-Olefins	0.941	0.967	0.836
	82.793	454	C9-Olefins	0.171	0.176	0.152
	83.106	460	C9-Olefins	0.122	0.126	0.109
	84.885	490	C9-Olefins	0.087	0.089	0.077
	86.189	508	C9-Olefin	0.150	0.154	0.134
	87.888	535	C9-Olefin	0.137	0.139	0.121
	88.539	560	C9-Olefin	0.089	0.090	0.079
	88.658	562	C9-Olefin	0.151	0.154	0.134
	88.869	564	C9-Olefin	0.021	0.021	0.018
	90.006	575	1-Nonene	0.099	0.101	0.088
	90.965	590	cis-3-Nonene	0.066	0.067	0.058
	91.746	604	trans-2-Nonene	0.511	0.516	0.453
	92.830	618	cis-2-Nonene	0.029	0.030	0.026
	93.051	622	C9-Olefins	0.316	0.320	0.281
	93.288	624	C9-Olefin	0.249	0.252	0.221
	95.825	650	C10-Olefin	0.133	0.134	0.107
	96.607	654	C10-Olefin	0.100	0.101	0.080
	99.705	670	C10-Olefin	0.041	0.042	0.033
Paraffin	35.357	96	n-Hexane	0.183	0.207	0.239
	57.634	200	n-Heptane	6.727	7.339	7.525
	77.480	400	n-Octane	5.571	5.913	5.466
	91.328	600	n-Nonane	4.325	4.495	3.780
	102.309	700	n-Decane	1.893	1.935	1.491
	111.189	800	n-Undecane	0.154	0.155	0.110
	117.920	895	n-Dodecane	0.005	0.005	0.003
Oxygenates						
Unidentified	79.375		Unidentified	0.053	0.055	0.046
	83.405		Unidentified	0.332	0.344	0.290
	86.133		Unidentified	0.067	0.069	0.060
	87.260		Unidentified	0.033	0.035	0.029
	88.945		Unidentified	0.021	0.021	0.019
	90.262		Unidentified	0.069	0.066	0.062
	90.329		Unidentified	0.015	0.015	0.014
	93.970		Unidentified	0.021	0.021	0.016
	94.069		Unidentified	0.016	0.017	0.013
	94.290		Unidentified	0.102	0.096	0.082
	95.143		Unidentified	0.099	0.093	0.088

Recovery = 100.00

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Components by Group

Group	Time	Component	%Wgt	%Vol	%Mol
Unidentified	95.694	Unidentified	0.054	0.050	0.048
	97.276	Unidentified	0.026	0.023	0.024
	98.115	Unidentified	0.074	0.075	0.058
	99.231	Unidentified	0.025	0.025	0.020
	99.533	Unidentified	0.081	0.081	0.065
	99.554	Unidentified	0.093	0.093	0.074
	99.854	Unidentified	0.118	0.120	0.093
	100.579	Unidentified	0.156	0.133	0.145
	101.239	Unidentified	0.019	0.020	0.016
	102.817	Unidentified	0.033	0.034	0.024
	103.454	Unidentified	0.020	0.017	0.017
	104.280	Unidentified	0.016	0.012	0.015
	104.804	Unidentified	0.036	0.037	0.026
	104.992	Unidentified	0.008	0.007	0.007
	106.996	Unidentified	0.029	0.025	0.024
	107.977	Unidentified	0.005	0.005	0.004
	108.938	Unidentified	0.058	0.058	0.042
	109.880	Unidentified	0.006	0.005	0.005
	110.001	Unidentified	0.008	0.008	0.006

Plus

Recovery = 100.00

Petroleum Product Stewardship Council

FILE COPY CAS # 64741-55-5

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VAPOR GENERATION FROM LIGHT CAT CRACKED NAPHTHA REPORT TO PETROLEUM PRODUCT STEWARDSHIP COUNCIL

CHEVRON RESEARCH AND TECHNOLOGY COMPANY

July 14, 1995

Introduction

The Petroleum Product Stewardship Council contracted with Chevron Research and Technology Company to prepare a sample of vapor distillate from Light Cat Cracked Naphtha (LCCN) as defined in Task Order 7 (see Appendix A). The distillate will be used as the test article in a Rat Reproductive/Developmental Screening study and a Rat 90-Day Neurotoxicity study both to be conducted by Pharmaco-LSR.

Sample Receipt/Characterization

The 2000-gallon LCCN sample was received from a refinery fluid catalytic cracking unit in March 1995. The LCCN sample was stored at ambient temperature in 55 gallon steel drums. An initial ASTM D86 Boiling Curve, D519 Vapor pressure, D2622 Sulfur, and SE-30 gas chromatography analysis were performed on this sample. Refer to Appendix B for analytical results.

Results of Task Order 7

A glass lined Pfaudler kettle (operated as a closed system) was initially charged with a total sample weight of 6570 pounds on April 26, 1995. The sample was slowly heated and stirred, the bottoms temperature was raised to a maximum of 194° F and the overhead to a maximum of 160° F (see Table 1 and Chart 1). A total of 910.0 pounds of distillate was recovered which represents 13.85% of total.

A second batch from the same sample was charged into the Pfaudler kettle on April 28, 1995 with a total sample weight of 6259.6 pounds. The sample was slowly heated and stirred, the bottoms temperature was raised to a maximum of 175° F and the overhead was raised to a maximum of 155° F (see Table 1 and Chart 2). A total of 896.3 pounds of distillate was collected. This represents 14.31% of the initial sample.

The distillate from both runs were chilled and uniformly mixed. The mixed Light Cat Cracked Naphtha Distillate (LCCND) was characterized by gas chromatography analysis (see Appendix C). A comparison of selected components in the starting liquid sample to the same components in the combined vapor distillate sample is shown in Table 2.

The chilled LCCND was mixed and transferred to 5-gallon DOT approved containers. All of the 5-gallon containers (1806.3 pounds of test material) were shipped to Pharmaco-LSR.

Table 1
PPSC Light Cat Cracked Naphtha Vapor Generation

Batch #1 (4/26/95)

Time (Hours)	Bottoms	Overhead
0.0	85	69
1.0	105	71
2.0	121	73
4.0	122	73
5.2	122	75
6.5	134	78
8.6	147	80
10.5	152	82
11.5	157	90
13.5	167	145
14.3	156	105
15.5	159	106
15.8	160	107
16.3	162	112
17.3	163	106
18.3	163	113
19.3	163	96
20.3	163	107
21.3	163	112
22.0	164	124
22.3	154	108
23.3	157	100
24.3	160	89
26.5	157	77
28.5	163	112
30.0	164	103
30.8	166	130
33.0	177	156
34.5	178	126
35.5	181	150
36.5	183	145
37.5	184	142
38.5	184	135
39.5	185	142
40.5	187	151
43.0	189	143
44.0	192	157
45.0	194	160

Batch 1:

Total Sample Carged (lbs)	6570.0
Total Overhead Recovered (lbs)	910.0
Overhead Recovered	**13.85%**

Batch 2:

Total Sample Carged (lbs)	6259.6
Total Overhead Recovered (lbs)	896.3
Overhead Recovered	**14.31%**

Batch # 2 (4/28/95)

Time (Hours)	Bottoms	Overhead
0.0	63	66
0.5	65	66
1.0	81	66
1.5	90	66
2.5	108	65
3.5	119	65
5.0	126	65
6.0	128	68
7.0	130	68
8.0	131	68
9.0	133	68
10.0	134	68
11.0	135	68
12.0	136	68
13.0	138	68
13.5	139	69
14.0	140	69
14.5	141	69
15.0	141	69
15.5	142	70
16.5	144	70
17.5	145	71
18.5	153	103
19.5	156	121
20.0	155	136
20.5	155	134
21.5	156	130
22.5	157	118
23.0	157	115
23.5	159	130
24.5	160	125
25.8	160	129
26.5	160	127
27.5	161	124
28.0	162	128
29.0	163	131
30.0	164	130
31.0	164	109
32.0	165	134
33.0	166	128
34.0	166	121
35.0	167	128
35.5	167	114
36.8	175	126
37.8	172	155
38.5	173	132

Chart 1
PPSC Light Cat Cracked Naphtha

Run 1

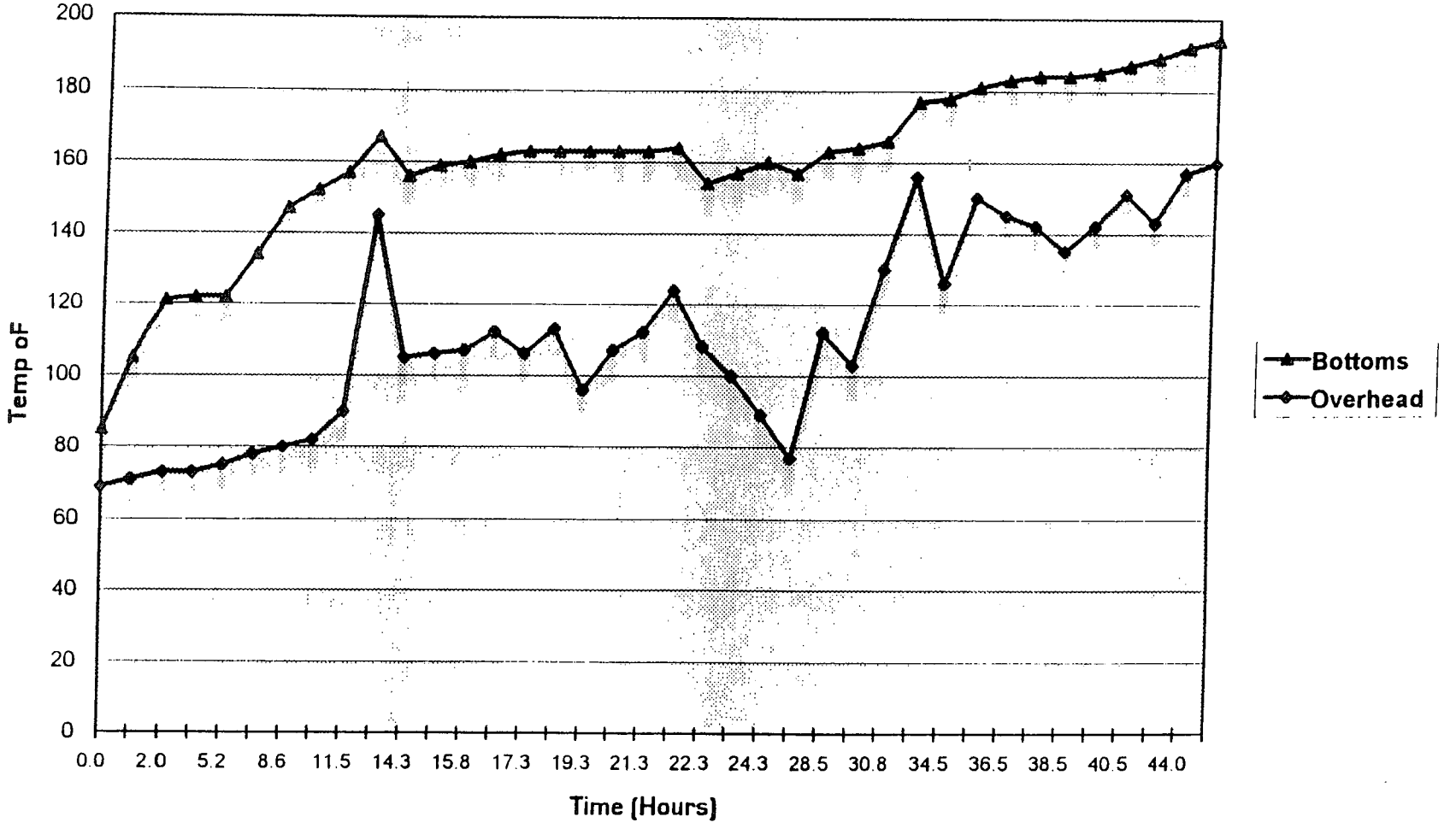


Chart 2
PPSC Light Cat Cracked Naphtha

Run 2

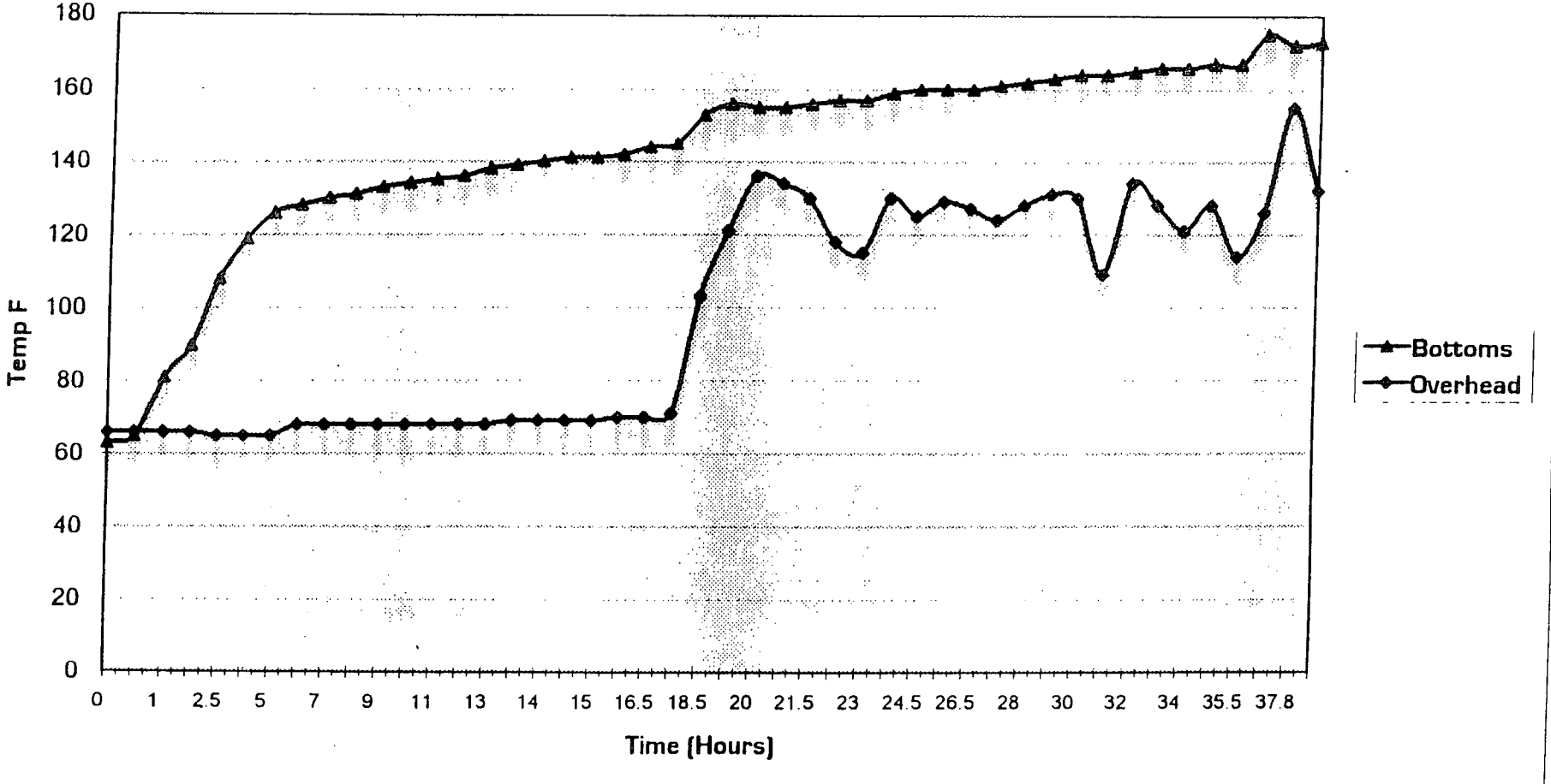


Table 2
Comparison of Selected LCCN and LCCND Components

Compound Vol%	LCCN Liquid	LCCND Vapor
n-butane	0.12	0.50
isobutane	0.02	0.10
2-butene (cis)	0.32	1.19
2-butene (trans)	0.22	0.87
n-pentane	1.6	3.51
isopentane	6.93	16.45
cyclopentane	0.27	0.39
1-pentene	1.23	2.95
2-pentene (trans)	3.59	7.54
2-pentene (cis)	2.03	4.21
3-methyl-1-butene	0.32	0.98
2-methyl-2-butene	5.66	10.94
2-methyl-1-butene	2.48	5.77
cyclopentene	0.69	1.16
n-hexane	1.52	1.59
methylcyclopentane	2.08	1.75
cyclohexane	0.26	0.15
2,2-dimethylbutane	0.03	0.05
2,3-dimethylbutane	1.04	1.37
2-methylpentane	4.6	5.72
3-methylpentane	2.78	3.11
2-methyl-2-pentene	1.73	1.70
2-methyl-1-pentene	1.14	1.28
3-methyl-2-pentene (cis)	1.11	1.01
3-methyl-2-pentene (trans)	1.76	1.49
1-hexene	0.66	0.73
2-hexene (cis)	0.88	0.83
2-hexene (trans)	1.84	1.76
3-hexene (cis)	1.56	1.57
1-methylcyclopentene	1.48	1.06
benzene	1.2	0.88
n-heptane	0.74	0.57
1-heptene	0.48	0.20
2-methylhexane	1.99	1.08
3-methylhexane	1.81	0.97
methylcyclohexane	1.29	0.43
toluene	5.61	1.74
n-octane	0.59	0.09
2-methylheptane	0.96	0.20
3-methylheptane	0.87	0.18
2,2,4-trimethylpentane	0.33	0.00
2,3,4-trimethylpentane	0.11	0.03
2,4-dimethylhexane	0.26	0.08
2,5-dimethylhexane	0.22	0.06
ethylbenzene	1.27	0.14
p-xylene	1.14	0.12
o-xylene	1.55	0.17
m-xylene	2.7	0.28
TOTALS (%)	**73.07**	**88.95**

LCCN Liquid is the starting refinery stream material.
LCCND Vapor is the combinded distillate from the two vapor generation procedures.

Appendix A

Task Order

PPSC TASK ORDER 7

Pursuant to the "Master Study Agreement for Toxicological Research Programs "between the Petroleum Product Stewardship Council and Chevron Research and Technology company, dated January 14, 1994, the parties hereby commission the following work:

Deliverables: 1) Acquisition of 2000 gallons of Light Cat Cracked Naphtha (LCCN -- CAS 64741-55-5) and analytical characterization including D519 vapor pressure, D86 boiling curve, D2622 sulfur, D5291 nitrogen, and SE-30 gas chromatography analysis. 2) Vapor generation and collection according to the procedures below. 3) Analytical characterization (SE-30) of the condensate. 4) Ship vapor condensate as directed by PPSC.

General Procedures: Vapor generation of the LCCN sample will be conducted using the procedures proposed for gasoline under CAA Section 211(b). Approximately one thousand gallons of LCCN, charged by weight, will be stirred and slowly heated till the vapor temperature reaches 130F or until fifteen percent of the starting weight is collected as condensate. The temperature of the liquid and vapor phase will be constantly monitored and recorded. The vapor will be condensed by passing through a chilled overhead collection system consisting of a 200 gallon primary receiving vessel chilled with water and 55 gallon secondary receiving vessels chilled with dry ice. This vapor generation procedure will be repeated with another sample of LCCN from the same lot. The vapor condensate from both procedures will be uniformly mixed and while chilled, transferred to 5 gallon containers for shipping. A sample of the mixed condensate will be analyszed by SE-30 gas chromatography.

Time Table: Sample acquisition will occur in March 1995 and vapor generation will occur in April 1995.

Payment Schedule: Payment is due upon receipt of invoice submitted after the vapor condensate is shipped. (Sample acquisition $1,000 plus shipping billed at cost. Analytical costs $700. Kettle operation $22,000. Project management $1,000. Shipping charges for the condensate samples will be passed along to PPSC at cost).

Study Director: Russell White
Study Monitor: Francis Koschier

SPONSOR

By: Charles R. Clark

Charles R. Clark
Petroleum Product
Stewardship Council

Date: 3/21/95

CONTRACTOR

By: _____

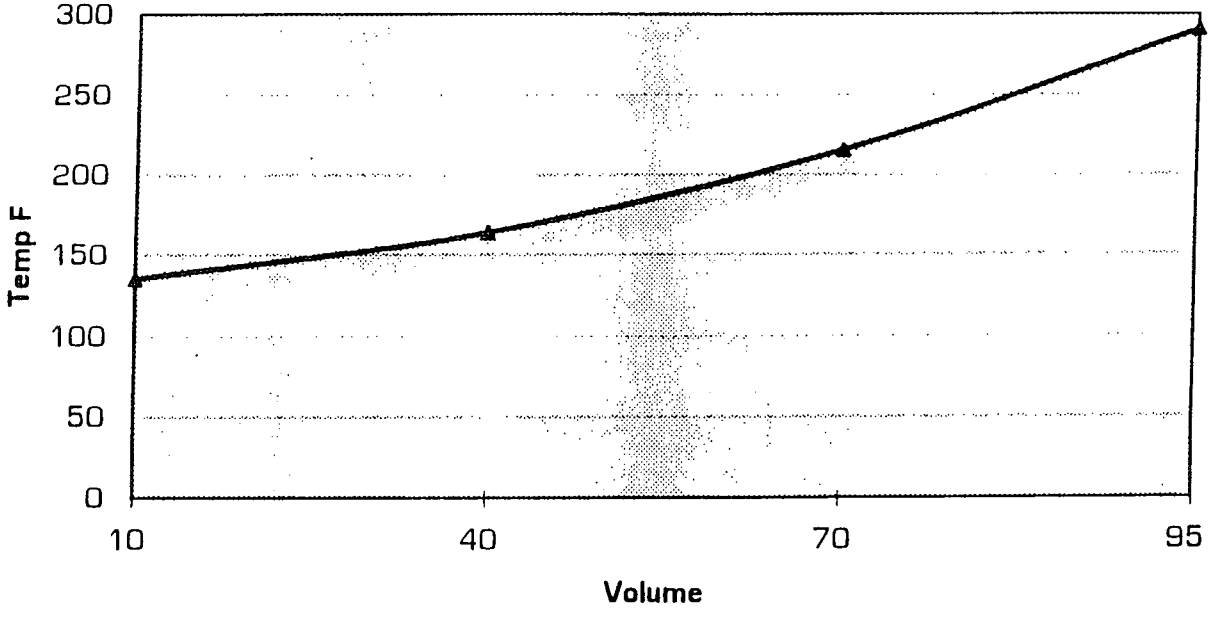
John C. Sebastian
Chevron Research and
Technology Company

Date: _____

Appendix B

Analytical Results

PPSC LCCN
Boiling Curve



-----> Deliver to: 51-2126 <-----

AIMS Result Report
For: HENLEY, M. C. (1176)
Project: LCCN

Date: 4/13/9
Time: 11:01
Page: 1

Charge code: TT14364 PPSC/REFINERY STREAM DISTIL

"A" No.	Id/Test/Element	Result	Unit	Approved	Analyst	Cost
5019772	WHOLE FEED PRODUCT					
	11111 D86 DIST. UPLOAD			13-Apr-95	ALET	$40.
	05ML	125.9 DEG F	10ML	134.7 DEG F	20ML	143.0 DEG F
	30ML	152.4 DEG F	40ML	164.3 DEG F	50ML	178.5 DEG F
	60ML	195.6 DEG F	70ML	214.7 DEG F	80ML	237.3 DEG F
	90ML	265.6 DEG F	95ML	289.9 DEG F	EPT	343.2 DEG F
	EPVOL	98.6 VOL %	EV05ML	125.0 DEG F	EV10ML	134.2 DEG F
	EV20ML	142.8 DEG F	EV30ML	151.8 DEG F	EV40ML	163.7 DEG F
	EV50ML	177.9 DEG F	EV60ML	195.0 DEG F	EV70ML	213.9 DEG F
	EV80ML	236.4 DEG F	EV90ML	264.5 DEG F	EV95ML	287.7 DEG F
	EVEPT	343.2 DEG F	EVEPVL	98.9 VOL %	EVIBP	95.3 DEG F
	IBP	95.3 DEG F	LOSS	0.3 VOL %	RECVRY	98.7 VOL %
	RESID	1.0 VOL %				

*** End of Report ***

-----> Deliver to: 51-2126 <-----

~~TST~~ 7

AIMS Result Report
For: HENLEY, M. C. (1176)
Project: LCCN

Date: 4/12/95
Time: 11:01 P
Page: 1

Charge code: TT14364 PPSC/REFINERY STREAM DISTIL

"A" No.	Id/Test/Element	Result	Unit	Approved	Analyst	Cost
5019774	WHOLE FEED PRODUCT					
	40005 SULFUR IN PET. PROD. LOW	78.	PPM	12-Apr-95	BJCL	$38.(

*** End of Report ***

-----> Deliver to: 51-2126 <-----

AIMS Result Report
For: HENLEY, M. C. (1176)
Project: LCCN

Date: 4/14/9
Time: 11:00
Page: 1

Charge code: TT14364 PPSC/REFINERY STREAM DISTIL

"A" No.	Id/Test/Element	Result	Unit	Approved	Analyst	Cost
5019771	WHOLE FEED PRODUCT					
	11304 MINI REID VAPOR PRESSURE	7.6	PSI	14-Apr-95	ALET	$45

*** End of Report ***

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 5019773 WHOLE FEED PRODUCT
Acquisition Date: 12-Apr-1995
Channel #: 6 Analysis: GASO549
Customer: MC HENLEY
Acquisition Time: 21:2(
Sample #: 2 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	*****
4	0.13	0.59	******	******	******	0.73	0.12	0.02	******	******	*****
5	8.53	16.35	0.27	******	******	25.15	1.60	6.93	******	0.27	*****
6	9.96	13.87	2.34	1.20	******	27.37	1.52	8.45	******	2.08	0.2
7	6.74	6.70	3.68	5.61	******	22.74	0.74	6.00	******	2.40	1.2
8	4.22	1.54	2.53	6.66	0.98	15.92	0.59	2.96	0.68	1.54	0.9
9	2.38	0.00	1.01	2.14	0.93	6.46	0.15	2.11	0.13	0.28	0.7
10	0.37	0.00	0.03	0.65	0.36	1.41	0.00	0.20	0.17	0.00	0.0
11	0.08	0.00	0.00	0.13	0.00	0.21	0.00	0.08	0.00	0.00	0.0
12+	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.0
TOT	32.42	39.05	9.86	16.38	2.28	100.00	4.70	26.75	0.97	6.56	3.3

2. BY WEIGHT

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	*****
4	0.11	0.51	******	******	******	0.62	0.09	0.02	******	******	*****
5	7.40	15.07	0.28	******	******	22.74	1.40	6.00	******	0.28	*****
6	9.15	13.42	2.45	1.46	******	26.49	1.39	7.75	******	2.17	0.2
7	6.43	6.68	3.89	6.78	******	23.78	0.71	5.72	******	2.51	1.3
8	4.14	1.54	2.72	8.05	1.00	17.45	0.57	2.90	0.66	1.64	1.0
9	2.39	0.00	1.11	2.60	0.96	7.06	0.15	2.12	0.13	0.29	0.8
10	0.37	0.00	0.04	0.81	0.38	1.59	0.00	0.20	0.17	0.00	0.0
11	0.09	0.00	0.00	0.17	0.00	0.25	0.00	0.09	0.00	0.00	0.0
12+	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.0
TOT	30.07	37.22	10.49	19.87	2.36	100.00	4.31	24.79	0.97	6.90	3.5

3. BY MOLAR

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	*****
4	0.17	0.81	******	******	******	0.97	0.14	0.02	******	******	*****
5	9.14	19.20	0.36	******	******	28.70	1.73	7.41	******	0.36	*****
6	9.47	14.26	2.60	1.67	******	28.00	1.44	8.02	******	2.30	0.3
7	5.72	6.09	3.53	6.56	******	21.90	0.63	5.09	******	2.28	1.2
8	3.23	1.23	2.16	6.76	0.80	14.17	0.45	2.26	0.52	1.30	0.8
9	1.66	0.00	0.78	1.93	0.68	5.06	0.10	1.47	0.09	0.21	0.5
10	0.23	0.00	0.02	0.54	0.24	1.04	0.00	0.12	0.11	0.00	0.0
11	0.05	0.00	0.00	0.10	0.00	0.15	0.00	0.05	0.00	0.00	0.0
12+	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.0
TOT	29.67	41.58	9.45	17.57	1.73	100.00	4.49	24.46	0.72	6.45	3.0

GRP. TYPE, VOL %: P = 33.18, O = 39.96, N = 10.09, A = 16.76, Saturates = 43.2
DIENE CONTENT = 4132. vol ppm AVG MW = 89.2 API GR. = 64.6 SP. GR. =0.721
OCTANE NUMBER: (from pure values) RON = 83.5 MON = 75.7
(from blending values) RON = 89.4 MON = 76.6
CARBON-HYDROGEN RATIO =6.226 STOICH. AIR-FUEL RATIO =14.64 lbs air/lbs fuel
BTU/lb = 15356. NET, 16504. GROSS; BTU/gal = 92490. NET, 99403. GROSS
REID VAPOR PRESSURE = 7.4 BROMINE NO. = 75.8

* DISTILLATION CURVES

VOL %	TBP	D86
0.	11.	97.
5.	82.	99.
10.	88.	101.
15.	97.	130.
20.	101.	140.
25.	112.	144.
30.	140.	146.
35.	146.	153.
40.	153.	156.
45.	156.	161.
50.	161.	176.
55.	179.	194.
60.	195.	197.
65.	204.	207.
70.	214.	228.
75.	231.	231.
80.	244.	245.
85.	258.	268.
90.	281.	280.
95.	292.	301.
100.	472.	367.

651	0.05	0.06	0.08	12-DIET BENZENE
653	0.01	0.02	0.02	1-ME-2-PR BENZENE
654	0.05	0.06	0.07	14-DIME2ET BENZENE
655	0.03	0.03	0.04	13-DIME4ET BENZENE
656	0.06	0.07	0.08	12-DIME4ET BENZENE
659	0.02	0.02	0.02	12-DIME3ET BENZENE
635	0.02	0.02	0.03	1245-TETME BENZENE
634	0.03	0.04	0.05	1235-TETME BENZENE
7800	0.03	0.03	0.04	METHYLINDANE A
660	0.01	0.01	0.01	1-ME35DIET BENZENE
7801	0.04	0.04	0.05	METHYLINDANE B
7004	0.01	0.01	0.02	C-11 AROMATIC E
755	0.01	0.02	0.02	1-ME-3NBU BENZENE
714	0.04	0.04	0.06	NAPHTHALENE
7830	0.01	0.01	0.01	DIMETHYLINDANE A
7831	0.02	0.02	0.03	DIMETHYLINDANE B
796	0.03	0.03	0.04	2-ME NAPHTHALENE
795	0.01	0.01	0.02	1-ME NAPHTHALENE

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
188	0.38	0.47	0.48	UNCLASS. H.C. C- 8
188	0.17	0.21	0.22	UNCLASS. H.C. C- 8
188	0.03	0.04	0.04	UNCLASS. H.C. C- 8
188	0.07	0.08	0.09	UNCLASS. H.C. C- 8
188	0.14	0.17	0.18	UNCLASS. H.C. C- 8
189	0.11	0.15	0.16	UNCLASS. H.C. C- 9
189	0.01	0.01	0.01	UNCLASS. H.C. C- 9
189	0.12	0.16	0.17	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.06	0.09	0.09	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.02	0.02	0.02	UNCLASS. H.C. C- 9
189	0.09	0.13	0.13	UNCLASS. H.C. C- 9
189	0.02	0.02	0.02	UNCLASS. H.C. C- 9
189	0.02	0.03	0.03	UNCLASS. H.C. C- 9
189	0.04	0.05	0.06	UNCLASS. H.C. C- 9
189	0.02	0.02	0.02	UNCLASS. H.C. C- 9
189	0.02	0.03	0.03	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.02	0.03	0.03	UNCLASS. H.C. C- 9
189	0.02	0.03	0.03	UNCLASS. H.C. C- 9
189	0.03	0.05	0.05	UNCLASS. H.C. C- 9
189	0.03	0.05	0.05	UNCLASS. H.C. C- 9
190	0.06	0.09	0.09	UNCLASS. H.C. C-10
4052	0.01	0.01	0.01	UNCLASSIFIED C-10 C
4053	0.02	0.03	0.03	UNCLASSIFIED C-10 D
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.02	0.03	0.03	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.02	0.02	0.02	UNCLASS. H.C. C-10

190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.09	0.13	0.14	UNCLASS. H.C. C-10
192	0.01	0.02	0.02	UNCLASS. H.C. C-12

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	0.14	0.12	0.09	N-BUTANE
6	1.73	1.60	1.40	N-PENTANE
9	1.44	1.52	1.39	N-HEXANE
14	0.63	0.74	0.71	N-HEPTANE
23	0.45	0.59	0.57	N-OCTANE
41	0.10	0.15	0.15	N-NONANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
5	0.02	0.02	0.02	ISOBUTANE
7	7.41	6.93	6.00	ISOPENTANE
12	0.03	0.03	0.03	22-DIME BUTANE
13	0.99	1.04	0.96	23-DIME BUTANE
10	4.34	4.60	4.19	2-ME PENTANE
11	2.66	2.78	2.57	3-ME PENTANE
18	0.03	0.04	0.04	22-DIME PENTANE
20	0.75	0.89	0.84	24-DIME PENTANE
19	0.99	1.15	1.11	23-DIME PENTANE
15	1.67	1.99	1.88	2-ME HEXANE
16	1.55	1.81	1.74	3-ME HEXANE
17	0.10	0.12	0.12	3-ET PENTANE
37	0.25	0.33	0.32	224-TRIME PENTANE
28	0.01	0.01	0.01	22-DIME HEXANE
36	0.02	0.02	0.02	223-TRIME PENTANE
31	0.16	0.22	0.21	25-DIME HEXANE
30	0.20	0.26	0.25	24-DIME HEXANE
38	0.05	0.06	0.06	233-TRIME PENTANE
39	0.08	0.11	0.11	234-TRIME PENTANE
34	0.29	0.37	0.37	2-ME-3-ET PENTANE
29	0.12	0.15	0.15	23-DIME HEXANE
24	0.73	0.96	0.93	2-ME HEPTANE
26	0.21	0.27	0.26	4-ME HEPTANE
25	0.67	0.87	0.86	3-ME HEPTANE
73	0.08	0.11	0.11	224-TRIME HEXANE
51	0.22	0.31	0.32	244-TRIME HEXANE
52	0.17	0.24	0.24	24-DIME HEPTANE
43	0.09	0.13	0.13	235-TRIME HEXANE
67	0.01	0.02	0.02	22-DIME HEPTANE
53	0.13	0.19	0.19	26-DIME HEPTANE
59	0.04	0.05	0.05	44-DIME HEPTANE
54	0.08	0.11	0.11	25-DIME HEPTANE
55	0.17	0.24	0.25	35-DIME HEPTANE
50	0.04	0.05	0.05	234-TRIME HEXANE
56	0.05	0.07	0.07	23-DIME HEPTANE
71	0.04	0.05	0.05	3-ME-4-ET HEXANE
57	0.06	0.08	0.08	34-DIME HEPTANE
66	0.03	0.05	0.05	4-ET HEPTANE

62	0.13	0.19	0.19	4-ME OCTANE
60	0.21	0.31	0.31	2-ME OCTANE
65	0.02	0.03	0.04	3-ET HEPTANE
4652	0.05	0.08	0.08	225-TRIME HEPTANE
4659	0.02	0.03	0.04	245-TRIME HEPTANE
151	0.01	0.02	0.02	22-DIME OCTANE
4650	0.03	0.05	0.05	223-TRIME HEPTANE
213	0.02	0.03	0.03	C-10 ISOPARAFFINS
86	0.02	0.03	0.04	4-ME NONANE
84	0.04	0.06	0.06	2-ME NONANE
85	0.04	0.06	0.06	3-ME NONANE
4663	0.01	0.01	0.01	335-TRIME HEPTANE
163	0.03	0.06	0.06	2-ME DECANE
164	0.01	0.02	0.02	3-ME DECANE

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.36	0.27	0.28	CYCLOPENTANE
801	2.30	2.08	2.17	ME CYCLOPENTANE
803	0.11	0.12	0.12	11-DIME CYCPENTANE
806	0.68	0.72	0.75	1C3-DIME CYCPENTANE
807	0.73	0.77	0.80	1T3-DIME CYCPENTANE
805	0.36	0.38	0.39	1T2-DIME CYCPENTANE
811	0.09	0.11	0.12	113-TRIME CPENTANE
802	0.40	0.41	0.44	ET CYCLOPENTANE
817	0.21	0.25	0.26	1T2C4TRIME CPENTANE
814	0.07	0.08	0.08	1T2C3TRIME CPENTANE
810	0.14	0.17	0.18	112-TRIME CPENTANE*
813	0.05	0.06	0.06	1C2T3TRIMECPENTANE*
848	0.18	0.24	0.25	11C3T4-TETRME CPENT
864	0.18	0.21	0.22	1MEC3ET CYCPENTANE
865	0.15	0.18	0.19	1MET3ET CYCPENTANE
861	0.25	0.29	0.32	1ME-1ET CYCPENTANE
812	0.05	0.06	0.07	1C2C3TRIMECPENTANE*
4326	0.03	0.04	0.04	C-9 CYCLOPENTANE B
862	0.11	0.12	0.14	1ME-C2ET CYPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
825	0.30	0.26	0.28	CYCLOHEXANE
826	1.25	1.29	1.38	ME CYCLOHEXANE
831	0.12	0.14	0.15	1C3-DIME CYCHEXANE
828	0.07	0.08	0.08	11-DIME CYCLHEXANE
830	0.14	0.16	0.17	1T2-DIME CYCHEXANE
832	0.22	0.25	0.28	1T3-DIME CYCHEXANE
833	0.24	0.27	0.30	1C4-DIME CYCHEXANE
827	0.08	0.09	0.10	ETHYL CYCLOHEXANE
946	0.03	0.04	0.04	113-TRIME CYCHEXANE
979	0.05	0.06	0.07	C-9 CYLOHEXANES
956	0.07	0.09	0.10	1C3T5-TRIME CYCHEX

945	0.04	0.05	0.05	112-TRIME CYCHEXANE
941	0.10	0.13	0.14	1ME-C3ET CYCHEXANE
944	0.03	0.04	0.05	1ME-T4ET CYCHEXANE
940	0.02	0.02	0.02	1ME-1-ET CYCHEXANE
949	0.10	0.13	0.14	1C2T3-TRIME CYCHEX
943	0.07	0.09	0.10	1M-C4-ET CYCHEXANE
948	0.06	0.07	0.08	1C2C3-TRIME CYCHEX
836	0.02	0.02	0.03	ISOPR CYCLOHEXANE
980	0.02	0.03	0.04	C-10 CYCLOHEXANES

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
302	0.03	0.02	0.02	1-BUTENE
305	0.04	0.03	0.03	ISO-BUTENE
304	0.30	0.22	0.19	TRANS-2-BUTENE
303	0.44	0.32	0.28	C1S-2-BUTENE
310	0.37	0.32	0.29	3-METHYL-1-BUTENE
306	1.40	1.23	1.10	1-PENTENE
309	2.86	2.48	2.25	2-METHYL-1-BUTENE
509	0.14	0.11	0.10	ISOPRENE
308	4.13	3.59	3.25	TRANS-2-PENTENE
327	0.05	0.05	0.04	3,3-DIME BUTENE
307	2.37	2.03	1.86	CIS-2-PENTENE
311	6.66	5.66	5.24	2-METHYL-2-BUTENE
505	0.17	0.13	0.13	T-13-PENTADIENE
530	0.04	0.03	0.03	CYCLOPENTADIENE
504	0.08	0.06	0.06	C-13-PENTADIENE
450	0.97	0.69	0.74	CYCLOPENTENE
318	0.57	0.57	0.53	3-METHYL-1-PENTENE
323	0.39	0.39	0.37	C-4ME-2-PENTENE
324	0.65	0.66	0.62	T-4ME-2-PENTENE
317	1.15	1.14	1.08	2-ME-1-PENTENE
312	0.66	0.66	0.62	1-HEXENE
315	1.57	1.56	1.48	CIS-3-HEXENE
314	1.84	1.84	1.74	TRANS-2-HEXENE
320	1.75	1.73	1.65	2-METHYL-2-PENTENE
321	1.14	1.11	1.07	C-3ME-2-PENTENE
313	0.90	0.88	0.85	CIS-2-HEXENE
322	1.81	1.76	1.71	T-3ME-2-PENTENE
2005	0.03	0.04	0.04	33-DIME-1-PENTENE
537	0.04	0.04	0.04	HEPTADIENES
4500	0.05	0.06	0.06	HEPTENE A
532	0.04	0.03	0.04	2-ME CYCLOPENTADIENE
2011	0.05	0.05	0.05	44-DIME-C2-PENTENE
4501	0.01	0.02	0.02	HEPTENE B
451	1.75	1.48	1.62	1-ME CYLCOPENTENE
2004	0.12	0.14	0.13	24-DIME-1-PENTENE
2017	0.03	0.04	0.04	3-ET 1-PENTENE
403	0.06	0.06	0.06	HEPTENES
2003	0.09	0.10	0.10	23-DIME-1-PENTENE
2024	0.07	0.08	0.08	5-ME-1-HEXENE
2009	0.14	0.16	0.15	24-DIME-CIS2-PENTENE

403	0.03	0.03	0.03	HEPTENES
403	0.06	0.07	0.07	HEPTENES
2033	0.30	0.35	0.33	2-ME-T3-HEXENE
2031	0.18	0.21	0.20	5-ME-T2-HEXENE
2010	0.10	0.11	0.11	34-DIME-C2-PENTENE
2038	0.42	0.48	0.46	1-HEPTENE
2035	0.19	0.21	0.21	3-ME-T3-HEXENE
5370	0.44	0.43	0.48	C-7 CYCLOPENTENE A
5371	0.41	0.40	0.44	C-7 CYCLOPENTENE B
2042	0.49	0.55	0.54	T3-HEPTENE
2025	0.50	0.56	0.55	2-ME-2-HEXENE
2034	0.71	0.78	0.78	3-ME-C3-HEXENE
2040	0.64	0.72	0.71	TRANS-2-HEPTENE
2008	0.46	0.50	0.51	23-DIME-C2-PENTENE
2039	0.44	0.49	0.49	CIS-2-HEPTENE
4526	0.03	0.03	0.03	OCTENE B
4529	0.05	0.07	0.07	OCTENE E
4530	0.03	0.04	0.04	OCTENE F
4527	0.06	0.07	0.07	OCTENE C
4532	0.04	0.05	0.05	OCTENE H
4528	0.17	0.22	0.22	OCTENE D
4533	0.09	0.11	0.11	OCTENE I
4534	0.08	0.10	0.10	OCTENE J
4531	0.03	0.04	0.04	OCTENE G
2212	0.02	0.03	0.03	6-ME-C2-HEPTENE
2213	0.04	0.05	0.05	6-ME-T2-HEPTENE
2193	0.26	0.32	0.32	1-OCTENE
2198	0.24	0.31	0.31	C4-OCTENE
4536	0.08	0.10	0.10	OCTENE L

AROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME
600	1.67	1.20	1.46	BENZENE
601	6.56	5.61	6.78	TOLUENE
602	1.29	1.27	1.54	ETHYLBENZENE
604	2.73	2.70	3.25	M-XYLENE
605	1.14	1.14	1.36	P-XYLENE
603	1.60	1.55	1.90	O-XYLENE
607	0.03	0.04	0.05	CUMENE
644	0.19	0.22	0.26	N-PROPYL BENZENE
609	0.53	0.60	0.72	1-ME-3-ET BENZENE
610	0.21	0.23	0.28	1-ME-4-ET BENZENE
613	0.18	0.20	0.25	135-TRIME BENZENE
608	0.14	0.16	0.19	1-ME-2-ET BENZENE
612	0.54	0.60	0.73	124-TRIME BENZENE
616	0.02	0.03	0.04	SEC BUTYLBENZENE
650	0.10	0.09	0.13	INDAN
621	0.01	0.01	0.01	O-CYMENE
646	0.03	0.04	0.05	13-DIETHYL BENZENE
647	0.05	0.07	0.08	1-ME-3-PR BENZENE
648	0.03	0.03	0.04	1-ME-4-PR BENZENE
614	0.02	0.02	0.03	N-BUTYLBENZENE

Appendix C

Vapor Generation Results

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 5025137 AVERAGED VAPOR CONDENSATE Customer: CARO
Acquisition Date: 8-May-1995 Acquisition Time: 11:30
Channel #: 6 Analysis: GASO552 Sample #: 2 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.60	2.32	******	******	******	2.92	0.50	0.10	******	******	******
5	19.95	34.28	0.39	******	******	54.63	3.51	16.45	******	0.39	******
6	11.84	13.87	1.89	0.88	******	28.48	1.59	10.25	******	1.75	0.15
7	4.06	2.89	1.50	1.74	******	10.18	0.57	3.49	******	1.07	0.43
8	0.98	0.25	0.45	0.70	0.11	2.48	0.09	0.66	0.23	0.30	0.16
9	0.17	0.00	0.04	0.94	0.03	1.18	0.00	0.15	0.02	0.04	0.00
10	0.00	0.00	0.00	0.12	0.00	0.12	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	37.60	53.61	4.28	4.38	0.14	100.00	6.26	31.10	0.24	3.55	0.73

2. BY WEIGHT

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.51	2.12	******	******	******	2.64	0.43	0.08	******	******	******
5	18.49	33.69	0.44	******	******	52.62	3.28	15.22	******	0.44	******
6	11.62	14.25	2.12	1.15	******	29.14	1.56	10.06	******	1.95	0.17
7	4.13	3.07	1.69	2.24	******	11.14	0.58	3.55	******	1.19	0.49
8	1.03	0.26	0.52	0.90	0.12	2.83	0.09	0.69	0.24	0.34	0.18
9	0.18	0.00	0.05	1.21	0.04	1.48	0.00	0.16	0.02	0.05	0.00
10	0.00	0.00	0.00	0.16	0.00	0.16	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	35.96	53.40	4.81	5.67	0.15	100.00	5.95	29.76	0.26	3.97	0.84

3. BY MOLAR

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.69	2.94	******	******	******	3.62	0.58	0.11	******	******	******
5	19.90	37.37	0.48	******	******	57.76	3.53	16.37	******	0.48	******
6	10.46	13.17	1.96	1.15	******	26.74	1.40	9.06	******	1.80	0.16
7	3.20	2.44	1.33	1.89	******	8.86	0.45	2.75	******	0.94	0.39
8	0.70	0.18	0.36	0.66	0.08	1.98	0.06	0.47	0.16	0.23	0.13
9	0.11	0.00	0.03	0.78	0.02	0.95	0.00	0.10	0.01	0.03	0.00
10	0.00	0.00	0.00	0.09	0.00	0.09	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	35.06	56.10	4.16	4.57	0.10	100.00	6.03	28.86	0.17	3.49	0.67

GRP. TYPE, VOL %: P = 37.65, O = 53.68, N = 4.29, A = 4.38, Saturates = 41.94
DIENE CONTENT = 7852. vol ppm AVG MW = 77.6 API GR. = 78.1 SP. GR. =0.6752
OCTANE NUMBER: (from pure values) RON = 89.4 MON = 80.2
(from blending values) RON = 97.5 MON = 81.5
CARBON-HYDROGEN RATIO =5.776 STOICH. AIR-FUEL RATIO =14.84 lbs air/lbs fuel
BTU/lb = 18224. NET, 19574. GROSS; BTU/gal =102688. NET, 110299. GROSS
REID VAPOR PRESSURE =13.4 BROMINE NO. =118.2

* DISTILLATION CURVES

VOL %	TBP	D86
0.	11.	82.
5.	82.	82.
10.	82.	86.
15.	82.	88.
20.	82.	97.
25.	88.	97.
30.	97.	97.
35.	97.	99.
40.	97.	101.
45.	101.	101.
50.	101.	101.
55.	101.	121.
60.	136.	140.
65.	140.	140.
70.	146.	146.
75.	153.	154.
80.	159.	159.
85.	168.	176.
90.	195.	197.
95.	231.	231.
100.	388.	326.

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	0.58	0.50	0.43	N-BUTANE
6	3.53	3.51	3.28	N-PENTANE
9	1.40	1.59	1.56	N-HEXANE
14	0.45	0.57	0.58	N-HEPTANE
23	0.06	0.09	0.09	N-OCTANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	0.11	0.10	0.08	ISOBUTANE	
7	16.37	16.45	15.22	ISOPENTANE	
12	0.04	0.05	0.05	22-DIME BUTANE	
13	1.22	1.37	1.36	23-DIME BUTANE	
10	5.02	5.72	5.57	2-ME PENTANE	
11	2.77	3.11	3.08	3-ME PENTANE	
18	0.02	0.03	0.03	22-DIME PENTANE	
20	0.53	0.68	0.69	24-DIME PENTANE	
21	0.02	0.02	0.02	33-DIME PENTANE	
19	0.51	0.64	0.66	23-DIME PENTANE	
15	0.84	1.08	1.09	2-ME HEXANE	
16	0.77	0.97	0.99	3-ME HEXANE	
17	0.05	0.06	0.07	3-ET PENTANE	
37	0.10	0.15	0.15	224-TRIME PENTANE	*
31	0.04	0.06	0.06	25-DIME HEXANE	
30	0.05	0.08	0.08	24-DIME HEXANE	
32	0.01	0.01	0.01	33-DIME HEXANE	
38	0.01	0.01	0.01	233-TRIME PENTANE	*
39	0.02	0.03	0.03	234-TRIME PENTANE	*
34	0.06	0.08	0.09	2-ME-3-ET PENTANE	
29	0.03	0.04	0.04	23-DIME HEXANE	*
24	0.14	0.20	0.21	2-ME HEPTANE	
26	0.04	0.06	0.06	4-ME HEPTANE	
25	0.13	0.18	0.19	3-ME HEPTANE	
73	0.01	0.02	0.02	224-TRIME HEXANE	
51	0.03	0.04	0.05	244-TRIME HEXANE	
43	0.01	0.02	0.02	235-TRIME HEXANE	*
53	0.01	0.02	0.02	26-DIME HEPTANE	
54	0.01	0.01	0.01	25-DIME HEPTANE	
55	0.02	0.02	0.03	35-DIME HEPTANE	
62	0.01	0.01	0.01	4-ME OCTANE	
60	0.01	0.02	0.02	2-ME OCTANE	

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.48	0.39	0.44	CYCLOPENTANE
801	1.80	1.75	1.95	ME CYCLOPENTANE

803	0.06	0.06	0.07	11-DIME CYCPENTANE
806	0.30	0.34	0.38	1C3-DIME CYCPENTANE
807	0.32	0.36	0.40	1T3-DIME CYCPENTANE
805	0.15	0.17	0.19	1T2-DIME CYCPENTANE
811	0.03	0.03	0.04	113-TRIME CPENTANE
802	0.12	0.13	0.15	ET CYCLOPENTANE
817	0.05	0.06	0.07	1T2C4TRIME CPENTANE
814	0.02	0.02	0.02	1T2C3TRIME CPENTANE
810	0.03	0.03	0.04	112-TRIME CPENTANE*
813	0.01	0.01	0.01	1C2T3TRIMECPENTANE*
848	0.03	0.04	0.05	11C3T4-TETRME CPENT
864	0.03	0.03	0.04	1MEC3ET CYCPENTANE
865	0.02	0.03	0.03	1MET3ET CYCPENTANE
861	0.04	0.05	0.05	1ME-1ET CYCPENTANE
862	0.02	0.02	0.03	1ME-C2ET CYPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
825	0.16	0.15	0.17	CYCLOHEXANE
826	0.39	0.43	0.49	ME CYCLOHEXANE
831	0.02	0.02	0.03	1C3-DIME CYCHEXANE
828	0.01	0.01	0.01	11-DIME CYCLHEXANE
830	0.02	0.02	0.03	1T2-DIME CYCHEXANE
832	0.03	0.03	0.04	1T3-DIME CYCHEXANE
833	0.03	0.04	0.05	1C4-DIME CYCHEXANE
829	0.01	0.01	0.01	1C2-DIME CYCHEXANE

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
302	0.12	0.10	0.09	1-BUTENE
305	0.19	0.16	0.14	ISO-BUTENE
304	1.09	0.87	0.79	TRANS-2-BUTENE
303	1.53	1.19	1.11	C1S-2-BUTENE
310	1.05	0.98	0.95	3-METHYL-1-BUTENE
506	0.01	0.01	0.01	14-PENTADIENE
306	3.13	2.95	2.82	1-PENTENE
309	6.20	5.77	5.60	2-METHYL-1-BUTENE
509	0.29	0.25	0.25	ISOPRENE
308	8.08	7.54	7.30	TRANS-2-PENTENE
327	0.09	0.10	0.10	3,3-DIME BUTENE
307	4.56	4.21	4.12	CIS-2-PENTENE
311	11.97	10.94	10.81	2-METHYL-2-BUTENE
505	0.33	0.29	0.29	T-13-PENTADIENE
530	0.08	0.06	0.07	CYCLOPENTADIENE
504	0.14	0.12	0.13	C-13-PENTADIENE
450	1.53	1.16	1.34	CYCLOPENTENE
319	0.60	0.65	0.65	4-METHYL-1-PENTENE
318	0.23	0.25	0.25	3-METHYL-1-PENTENE
323	0.51	0.55	0.55	C-4ME-2-PENTENE
324	0.79	0.86	0.86	T-4ME-2-PENTENE

317	1.20	1.28	1.30	2-ME-1-PENTENE
312	0.68	0.73	0.74	1-HEXENE
315	1.47	1.57	1.60	CIS-3-HEXENE
314	1.64	1.76	1.78	TRANS-2-HEXENE
320	1.60	1.70	1.74	2-METHYL-2-PENTENE
321	0.96	1.01	1.05	C-3ME-2-PENTENE
313	0.78	0.83	0.85	CIS-2-HEXENE
322	1.43	1.49	1.54	T-3ME-2-PENTENE
2005	0.02	0.03	0.03	33-DIME-1-PENTENE
537	0.03	0.03	0.04	HEPTADIENES
4500	0.04	0.05	0.05	HEPTENE A
532	0.02	0.02	0.03	2-ME CYCLOPENTADIENE
2011	0.03	0.04	0.04	44-DIME-C2-PENTENE
4501	0.01	0.01	0.01	HEPTENE B
451	1.16	1.06	1.23	1-ME CYLCOPENTENE
2004	0.07	0.09	0.09	24-DIME-1-PENTENE
2017	0.02	0.02	0.02	3-ET 1-PENTENE
403	0.03	0.04	0.04	HEPTENES
2003	0.05	0.06	0.06	23-DIME-1-PENTENE
2024	0.04	0.04	0.05	5-ME-1-HEXENE
2009	0.08	0.09	0.10	24-DIME-CIS2-PENTENE
403	0.01	0.02	0.02	HEPTENES
403	0.03	0.04	0.04	HEPTENES
2033	0.16	0.19	0.20	2-ME-T3-HEXENE
2031	0.09	0.11	0.11	5-ME-T2-HEXENE
2021	0.04	0.05	0.05	2-ME-1-HEXENE
2038	0.17	0.20	0.21	1-HEPTENE
2035	0.08	0.09	0.10	3-ME-T3-HEXENE
5370	0.17	0.18	0.21	C-7 CYCLOPENTENE A
5371	0.16	0.16	0.19	C-7 CYCLOPENTENE B
2042	0.17	0.21	0.22	T3-HEPTENE
2025	0.18	0.22	0.23	2-ME-2-HEXENE
2034	0.25	0.30	0.32	3-ME-C3-HEXENE
2040	0.21	0.26	0.27	TRANS-2-HEPTENE
2008	0.15	0.18	0.20	23-DIME-C2-PENTENE
2039	0.15	0.18	0.19	CIS-2-HEPTENE
4529	0.01	0.02	0.02	OCTENE E
4527	0.01	0.02	0.02	OCTENE C
4532	0.01	0.01	0.01	OCTENE H
4528	0.03	0.05	0.05	OCTENE D
4533	0.02	0.02	0.02	OCTENE I
4534	0.01	0.02	0.02	OCTENE J
4531	0.01	0.01	0.01	OCTENE G
2193	0.04	0.05	0.05	1-OCTENE
2198	0.03	0.04	0.04	C4-OCTENE
4536	0.01	0.01	0.01	OCTENE L

AROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME
600	1.15	0.88	1.15	BENZENE
601	1.89	1.74	2.24	TOLUENE
602	0.13	0.14	0.18	ETHYLBENZENE

604	0.26	0.28	0.35	M-XYLENE
605	0.11	0.12	0.15	P-XYLENE
603	0.16	0.17	0.22	O-XYLENE *
644	0.05	0.06	0.07	N-PROPYL BENZENE
609	0.20	0.24	0.30	1-ME-3-ET BENZENE
610	0.09	0.10	0.13	1-ME-4-ET BENZENE
613	0.09	0.11	0.15	135-TRIME BENZENE
608	0.05	0.06	0.08	1-ME-2-ET BENZENE *
612	0.26	0.31	0.41	124-TRIME BENZENE *
611	0.03	0.04	0.05	123-TRIME BENZENE *
650	0.01	0.01	0.01	INDAN *
646	0.01	0.01	0.02	13-DIETHYL BENZENE
647	0.01	0.01	0.02	1-ME-3-PR BENZENE
648	0.01	0.01	0.02	1-ME-4-PR BENZENE
651	0.01	0.02	0.02	12-DIET BENZENE *
656	0.03	0.03	0.05	12-DIME4ET BENZENE *

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
188	0.02	0.03	0.03	UNCLASS. H.C. C- 8
188	0.03	0.04	0.04	UNCLASS. H.C. C- 8
188	0.01	0.01	0.01	UNCLASS. H.C. C- 8
188	0.02	0.02	0.03	UNCLASS. H.C. C- 8
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9

CAS # 64741-63-5

073816

11.017

VAPOR GENERATION FROM LIGHT CATALYTICALLY REFORMED NAPHTHA REPORT TO PETROLEUM PRODUCT STEWARSHIP COUNCIL

CHEVRON RESEARCH AND TECHNOLOGY COMPANY

DECEMBER 9, 1996

Introduction

The Petroleum Product Stewardship Council contracted with Chevron Research and Technology Company to prepare a sample of vapor distillate from Light Catalytically Reformed Naphtha (LCRN) as defined in Task Order 8 (see Appendix A). The distillate will be used as the test article in a Rat Reproductive/Developmental Screening study and a Rat 90-day Neurotoxicity study, both to be conducted by Huntingdon LS.

Sample Receipt/Characterization

The 2000-gallon LCRN sample was received from Amoco Corporation on September 3, 1996. The LCRN sample was stored at ambient temperature in new 55-gallon drums. An initial ASTM D86 Boiling Curve, D519 Vapor pressure and SE-30 gas chromatography analysis were performed on the sample. See Appendix B for analytical results.

Results of Task Order 8

A glass-lined Pfaudler Kettle (operated as a closed system) was initially charged with a total sample weight of 6479.2 pounds on October 7, 1996. The sample was slowly heated and stirred, the bottoms temperature raised to a maximum of 154°F and the overhead temperature to a maximum of 147°F (See Table 1 and Chart 1). A total of 973.0 pounds of distillate was collected, representing 15.02% of the total.

A second batch from the same sample was charged into the Pfaudler Kettle on October 10, 1996, with a total sample weight of 6589.4 pounds. The sample was slowly heated and stirred, the bottoms temperature raised to a maximum of 154°F and the overhead temperature to a maximum of 147°F (see Table 1 and Chart 2). A total of 988.6 pounds of distillate was collected, representing 15.00% of the total.

The distillate from both runs was chilled and uniformly mixed. The mixed Light Catalytically Reformed Naphtha Distillate (LCRND) was characterized by gas chromatography (see Appendix C). A comparison of selected components in the starting liquid sample with the same components in the combined vapor distillate sample is shown in Table 2.

The chilled LCRND (total of 1961.6 pounds) was transferred to 5-gallon DOT approved containers and shipped to Huntingdon LS on October 22, 1996. A one-quart sample was shipped to Dustek, Inc., for determination of lower explosive limit.

Chart 2
PPSC Light Catalytically Reformed Naphtha (LCRN) Vapor Generation
Batch 2, 10/10/96

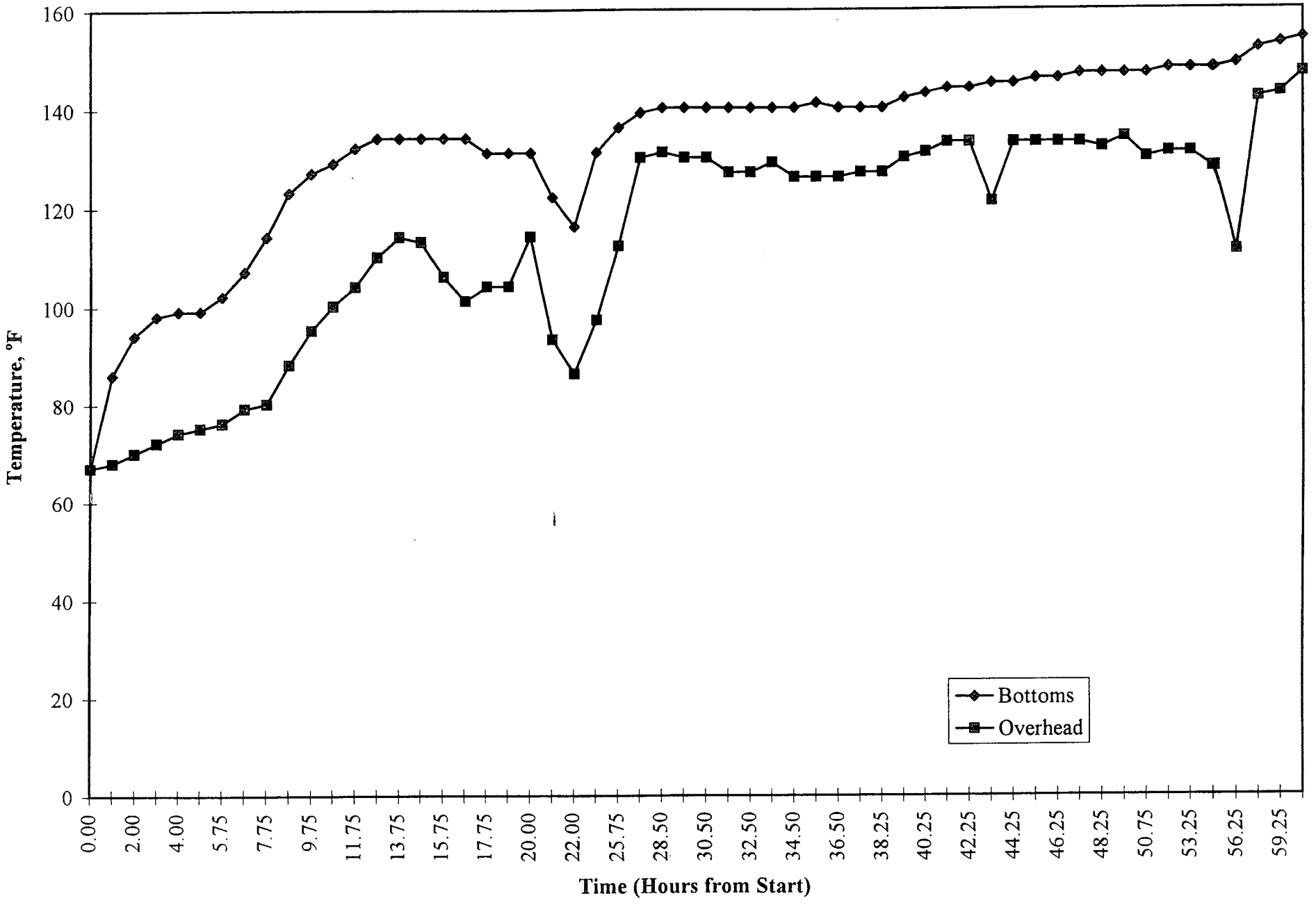


Table 2
Comparison of Selected Components
Light Catalytically Reformed Naphtha (LCRN) and Distillate (LCRND)

Compound	LCRN Liquid	LCRND - Vapor Condensate*
n-butane	0.78	2.97
n-pentane	8.05	20.56
n-hexane	4.69	4.49
n-heptane	3.59	1.00
n-octane	0.40	0.03
isobutane	0.03	0.10
isopentane	11.39	34.23
22-dimethylbutane	1.26	2.26
23-dimethylbutane	1.11	1.56
2-methylpentane	5.17	6.78
3-methylpentane	4.00	4.71
22-dimethylpentane	0.72	0.47
24-dimethylpentane	0.84	0.53
33-dimethylpentane	0.87	0.46
23-dimethylpentane	1.70	0.72
2-methylhexane	4.30	1.75
3-methylhexane	5.18	1.97
3-ethylpentane	0.49	0.17
22-dimethylhexane	0.14	0.03
25-dimethylhexane	0.18	0.03
24-dimethylhexane	0.29	0.05
33-dimethylhexane	0.11	0.02
23-dimethylhexane	0.21	0.03
2-methylheptane	0.67	0.08
4-methylheptane	0.29	0.03
3-methylheptane	0.79	0.09
cyclopentane	0.26	0.45
methylcyclopentane	0.62	0.53
11-dimethylcyclopentane	0.10	0.05
1C3-dimethylcyclopentane	0.19	0.07
1T3-dimethylcyclopentane	0.17	0.07
1T2-dimethylcyclopentane	0.23	0.09
methylcyclohexane	0.41	0.11
2-methyl-1-butene	0.07	0.20
2-methyl-2-butene	0.16	0.36
trans-2-pentene	0.05	0.14
benzene	8.37	6.21
toluene	29.77	5.78
ethylbenzene	0.45	0.03
m-xylene	0.49	0.03
p-xylene	0.27	0.01
o-xylene	0.05	0.00
Totals, % Weight	**98.91**	**99.25**

*Blend of condensates from Batch 1 and Batch 2

APPENDIX A

TASK ORDER 8

PPSC TASK ORDER 8

Pursuant to the "Master Study Agreement for Toxicological Research Program" between the Petroleum Product Stewardship Council and Chevron Research and Technology company, dated January 14, 1994, the parties hereby commission the following work:

Deliverables: 1) Unload 2000 gallons of Light Catalytically Reformed Naphtha (LCRN) from tanker truck. (Cost of delivery billed directly to PPSC.) 2) Analytical characterization of LCRN including D519 vapor pressure, D86 boiling curve, D2622 sulfur, D5291 nitrogen, and SE-30 gas chromatography analysis. 3) Generation of vapor condensate according to the procedures below. 4) Analytical characterization (SE-30) of the blended condensate sample. 5) Ship vapor condensate as directed by PPSC.

General Procedures: Vapor generation of the LCRN sample will be conducted using the procedures proposed for gasoline under CAA Section 211(b). Approximately one thousand gallons of LCRN will be charged by volume. The sample will be stirred and slowly heated until the vapor temperature reaches 130F or fifteen percent of the starting volume is collected as condensate. (Based on data from the benchtop vapor generation done last year, we will likely take 15% of the starting volume.) The temperature of the liquid and vapor phase will be constantly monitored and recorded. The vapor will be condensed by passing through a chilled overhead collection system. This vapor generation procedure will be repeated with another sample of LCRN from the same lot. The vapor condensate from both procedures will be uniformly mixed and while chilled, transferred to 5 gallon containers for shipping. A sample of the mixed condensate will be analyzed by SE-30 gas chromatography.

Time Table: Vapor generation will occur within two months of delivery of LCRN.

Payment Schedule: Total cost approximately $27,000 plus cost of shipping the vapor condensate sample. Payment is due upon receipt of invoice submitted after the vapor condensate is shipped. (Unloading 2000 gallons of sample $3,200, Analytical costs $800, Vapor generation $22,000, Project management $1,000. Shipping charges for the condensate samples will be passed along to PPSC at cost).

Study Director: Russell White
Study Monitor: Francis Koschier

SPONSOR

By: Charles R. Clark

Charles R. Clark
Petroleum Product
Stewardship Council

Date: 6/11/96

CONTRACTOR

By: John C. Sebastian

John C. Sebastian
Chevron Research and
Technology Company

Date: June 3, 1996

APPENDIX B

ANALYTICAL RESULTS
LIGHT CATALYTICALLY CRACKED NAPHTHA

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 6050335 REFORMATE 9/3/96 Customer: CARR
Acquisition Date: 4-Sep-1996 Acquisition Time: 09:19
Channel #: 13 Analysis: GASO179 Sample #: 5 Injection #: 1

7.1, R-C

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	1.02	0.00	******	******	******	1.02	0.98	0.04	******	******	******
5	22.72	0.38	0.25	******	******	23.34	9.34	13.38	******	0.25	******
6	17.95	0.28	0.60	6.93	******	25.76	5.18	12.77	******	0.60	0.00
7	18.83	0.29	1.14	25.01	******	45.27	3.83	15.00	******	0.75	0.39
8	3.23	0.01	0.26	1.06	0.00	4.56	0.41	2.56	0.26	0.18	0.08
9	0.02	0.00	0.03	0.00	0.00	0.05	0.00	0.02	0.00	0.03	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	63.76	0.96	2.28	33.00	0.00	100.00	19.73	43.76	0.26	1.81	0.46

2. BY WEIGHT

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.81	0.00	******	******	******	0.81	0.78	0.03	******	******	******
5	19.45	0.34	0.26	******	******	20.05	8.05	11.41	******	0.26	******
6	16.23	0.27	0.62	8.37	******	25.49	4.69	11.54	******	0.62	0.00
7	17.70	0.28	1.18	29.77	******	48.94	3.59	14.11	******	0.77	0.41
8	3.12	0.01	0.27	1.26	0.00	4.66	0.40	2.47	0.25	0.19	0.08
9	0.02	0.00	0.03	0.00	0.00	0.05	0.00	0.02	0.00	0.03	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	57.34	0.90	2.36	39.40	0.00	100.00	17.51	39.57	0.25	1.87	0.49

3. BY MOLAR

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	1.21	0.00	******	******	******	1.21	1.17	0.04	******	******	******
5	23.35	0.42	0.32	******	******	24.08	9.66	13.69	******	0.32	******
6	16.31	0.28	0.64	9.28	******	26.50	4.71	11.60	******	0.64	0.00
7	15.30	0.25	1.04	27.98	******	44.57	3.11	12.19	******	0.68	0.36
8	2.36	0.01	0.21	1.02	0.00	3.61	0.30	1.87	0.19	0.15	0.06
9	0.01	0.00	0.02	0.00	0.00	0.03	0.00	0.01	0.00	0.02	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	58.54	0.95	2.23	38.28	0.00	100.00	18.94	39.40	0.19	1.80	0.42

GRP. TYPE, VOL %: P = 63.76, O = 0.96, N = 2.28, A = 33.00, Saturates = 66.03
DIENE CONTENT = 0. vol ppm AVG MW = 86.6 API GR. = 61.7 SP. GR. =0.7325
OCTANE NUMBER: (from pure values) RON = 81.3 MON = 76.6
(from blending values) RON = 84.9 MON = 79.4
CARBON-HYDROGEN RATIO =6.547 STOICH. AIR-FUEL RATIO =14.50 lbs air/lbs fuel
BTU/lb = 11649. NET, 12588. GROSS; BTU/gal = 71206. NET, 76942. GROSS
REID VAPOR PRESSURE = 7.1 BROMINE NO. = 1.8

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	1.17	0.98	0.78	N-BUTANE
6	9.66	9.34	8.05	N-PENTANE
9	4.71	5.18	4.69	N-HEXANE
14	3.11	3.83	3.59	N-HEPTANE
23	0.30	0.41	0.40	N-OCTANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	0.04	0.04	0.03	ISOBUTANE	
8	0.02	0.02	0.02	NEOPENTANE	
7	13.67	13.35	11.39	ISOPENTANE	
12	1.27	1.41	1.26	22-DIME BUTANE	
13	1.12	1.22	1.11	23-DIME BUTANE	
10	5.19	5.75	5.17	2-ME PENTANE	
11	4.02	4.38	4.00	3-ME PENTANE	
18	0.63	0.78	0.72	22-DIME PENTANE	
20	0.73	0.91	0.84	24-DIME PENTANE	
21	0.75	0.91	0.87	33-DIME PENTANE	
19	1.47	1.78	1.70	23-DIME PENTANE	
15	3.71	4.61	4.30	2-ME HEXANE	
16	4.48	5.49	5.18	3-ME HEXANE	
17	0.43	0.51	0.49	3-ET PENTANE	
37	0.02	0.03	0.03	224-TRIME PENTANE	*
28	0.10	0.14	0.14	22-DIME HEXANE	
36	0.01	0.01	0.01	223-TRIME PENTANE	*
31	0.14	0.19	0.18	25-DIME HEXANE	
30	0.22	0.30	0.29	24-DIME HEXANE	
32	0.08	0.11	0.11	33-DIME HEXANE	
29	0.16	0.22	0.21	23-DIME HEXANE	*
24	0.51	0.70	0.67	2-ME HEPTANE	
26	0.22	0.30	0.29	4-ME HEPTANE	
25	0.60	0.82	0.79	3-ME HEPTANE	
55	0.01	0.02	0.02	35-DIME HEPTANE	

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.32	0.25	0.26	CYCLOPENTANE
801	0.64	0.60	0.62	ME CYCLOPENTANE
803	0.09	0.09	0.10	11-DIME CYCPENTANE
806	0.16	0.18	0.19	1C3-DIME CYCPENTANE
807	0.15	0.17	0.17	1T3-DIME CYCPENTANE
805	0.20	0.22	0.23	1T2-DIME CYCPENTANE
811	0.03	0.03	0.04	113-TRIME CPENTANE
802	0.08	0.08	0.09	ET CYCLOPENTANE
817	0.03	0.04	0.04	1T2C4TRIME CPENTANE

600	9.28	6.93	8.37	BENZENE
601	27.98	25.01	29.77	TOLUENE
602	0.37	0.38	0.45	ETHYLBENZENE
604	0.40	0.41	0.49	M-XYLENE
605	0.22	0.23	0.27	P-XYLENE
603	0.04	0.04	0.05	O-XYLENE

APPENDIX C

ANALYTICAL RESULTS
LIGHT CATALYTICALLY CRACKED NAPHTHA DISTILLATE

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 6059939 VAPOR CONDENSATE LCRN Customer: CARO
Acquisition Date: 15-Oct-1996 Acquisition Time: 15:29
Channel #: 13 Analysis: GASO191 Sample #: 2 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	3.48	0.11	******	******	******	3.60	3.37	0.11	******	******	******
5	57.84	0.88	0.39	******	******	59.11	21.57	36.27	******	0.39	******
6	19.79	0.28	0.46	4.65	******	25.18	4.47	15.32	******	0.46	0.00
7	6.81	0.10	0.35	4.39	******	11.65	0.96	5.85	******	0.26	0.10
8	0.38	0.00	0.03	0.05	0.00	0.46	0.03	0.31	0.04	0.03	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	88.30	1.37	1.24	9.09	0.00	100.00	30.40	57.86	0.04	1.14	0.10

2. BY WEIGHT

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	3.07	0.10	******	******	******	3.17	2.97	0.10	******	******	******
5	54.79	0.88	0.45	******	******	56.12	20.56	34.23	******	0.45	******
6	19.79	0.29	0.53	6.21	******	26.82	4.49	15.31	******	0.53	0.00
7	7.08	0.11	0.40	5.78	******	13.37	1.00	6.08	******	0.29	0.11
8	0.40	0.00	0.03	0.07	0.00	0.51	0.03	0.33	0.04	0.03	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	85.14	1.38	1.41	12.06	0.00	100.00	29.06	56.05	0.04	1.30	0.12

3. BY MOLAR

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	4.08	0.14	******	******	******	4.22	3.95	0.13	******	******	******
5	58.64	0.97	0.49	******	******	60.10	22.01	36.63	******	0.49	******
6	17.74	0.27	0.48	6.14	******	24.62	4.02	13.72	******	0.48	0.00
7	5.45	0.08	0.32	4.85	******	10.70	0.77	4.69	******	0.23	0.09
8	0.27	0.00	0.02	0.05	0.00	0.35	0.02	0.22	0.03	0.02	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	86.18	1.46	1.32	11.04	0.00	100.00	30.77	55.39	0.03	1.23	0.09

GRP. TYPE, VOL %: P = 88.30, O = 1.37, N = 1.24, A = 9.09, Saturates = 89.54
DIENE CONTENT = 12. vol ppm AVG MW = 77.2 API GR. = 82.3 SP. GR. =0.6619
OCTANE NUMBER: (from pure values) RON = 79.5 MON = 77.5
(from blending values) RON = 82.4 MON = 80.0
CARBON-HYDROGEN RATIO =5.427 STOICH. AIR-FUEL RATIO =15.03 lbs air/lbs fuel
BTU/lb = 16974. NET, 18356. GROSS; BTU/gal = 93759. NET, 101394. GROSS
REID VAPOR PRESSURE =14.9 BROMINE NO. = 3.0

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	3.95	3.37	2.97	N-BUTANE
6	22.01	21.57	20.56	N-PENTANE
9	4.02	4.47	4.49	N-HEXANE
14	0.77	0.96	1.00	N-HEPTANE
23	0.02	0.03	0.03	N-OCTANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
5	0.13	0.11	0.10	ISOBUTANE
7	36.63	36.27	34.23	ISOPENTANE
12	2.02	2.28	2.26	22-DIME BUTANE
13	1.40	1.55	1.56	23-DIME BUTANE
10	6.07	6.82	6.78	2-ME PENTANE
11	4.22	4.67	4.71	3-ME PENTANE
18	0.36	0.46	0.47	22-DIME PENTANE
20	0.41	0.51	0.53	24-DIME PENTANE
21	0.35	0.44	0.46	33-DIME PENTANE
19	0.56	0.68	0.72	23-DIME PENTANE
15	1.35	1.70	1.75	2-ME HEXANE
16	1.52	1.89	1.97	3-ME HEXANE
17	0.13	0.16	0.17	3-ET PENTANE
28	0.02	0.03	0.03	22-DIME HEXANE
31	0.02	0.03	0.03	25-DIME HEXANE
30	0.03	0.05	0.05	24-DIME HEXANE
32	0.01	0.02	0.02	33-DIME HEXANE
29	0.02	0.03	0.03	23-DIME HEXANE *
24	0.05	0.08	0.08	2-ME HEPTANE
26	0.02	0.03	0.03	4-ME HEPTANE
25	0.06	0.08	0.09	3-ME HEPTANE

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.49	0.39	0.45	CYCLOPENTANE
801	0.48	0.46	0.53	ME CYCLOPENTANE
803	0.04	0.04	0.05	11-DIME CYCPENTANE
806	0.06	0.06	0.07	1C3-DIME CYCPENTANE
807	0.05	0.06	0.07	1T3-DIME CYCPENTANE
805	0.07	0.08	0.09	1T2-DIME CYCPENTANE
802	0.02	0.02	0.02	ET CYCLOPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
826	0.09	0.10	0.11	ME CYCLOHEXANE

CAS # 64741-66-8

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069673

VAPOR GENERATION FROM LIGHT ALKYLATE NAPHTHA
REPORT TO PETROLEUM PRODUCT STEWARDSHIP COUNCIL

CHEVRON RESEARCH AND TECHNOLOGY COMPANY

11.017

March 1, 1995

Introduction

The Petroleum Product Stewardship Council contracted with Chevron Research and Technology Company to prepare a sample of vapor distillate from Light Alkylate Naphtha (LAN) and to determine the quantity and composition of the distillate as defined in Task Order 5.

Sample Receipt/Characterization

The 1,000 gallon LAN sample was collected from a refinery sulfuric acid alkylation unit in December, 1994. The LAN sample was stored at ambient temperature in 55 gallon steel drums. An initial ASTM D86 Boiling Curve, RVP, and SE-30 gas chromatography analysis were performed on this sample. Refer to Appendix A for analytical results.

Results of Task Order 5

A glass lined Pfaudler kettle (operated as a closed system) was charged with a total sample weight of 5,713.4 lbs on December 18, 1994. The sample was slowly heated and stirred, the bottoms temperature was raised from 67F to 170F, the overhead from 69F to 130F (see Chart 1). A total of 16 lbs of distillate was recovered which represents 0.28% of total.

The LAN sample that was charged on December 18, 1994 was left in the closed system and on January 3, 1995 heating/stirring again took place. The bottoms temperature was raised from 68F to 202F and the overhead was raised to 189F (see Chart 2). A total of 883 lbs of distillate was collected. This represents 15.46% of the initial sample.

The Light Alkylate Naphtha Distillate (LAND) was characterized by SE-30 gas chromatography analysis (see Appendix B). The ASTM D2622, D5291 and D56 for sulfur, nitrogen and flash point, respectively, were inadvertently not conducted.

The chilled LAND was mixed and was transferred to 5-gallon DOT approved containers. One quart samples were sent to Stoneybrook Laboratories, Inc. and to Dustech, Inc. The remaining distillate (156 gallons) was sent to Pharmaco-LSR.

Comparison of Results from Distillation or Vapor Generation for Light Alkylate Naphtha

See Tables 2-3.

Table 1

PPSC LAN Vapor Generation

LAN FIRST RUN		
TIME	TEMPERATURE	
Hours	Bottoms	Overhead
0	69	69
1	87	72
2	109	72
3	119	73
4	123	73
5	125	74
6	126	76
7	126	76
8	126	77
9.5	126	76
10.5	128	75
11.5	129	73
12.5	131	73
13.5	135	72
14.5	137	
15.5	141	
16.5	142	
17	143	
18	146	73
19	150	72
20	152	74
21.5	162	80
22	166	95
22.1	168	110
22.2	169	117
22.7	170	130

Total (lbs) LAN Charged = **5713**
Total Overhead Recovered (lbs) = **16**
% Overhead Recovered = **0.28%**

SECOND LAN RUN		
TIME	TEMPERATURE	
Hours	Bottoms	Overhead
0	68	
1	124	91
2.5	150	82
3.5	158	79
4.5	165	85
5.5	172	122
6.5	174	141
7.5	176	149
8.5	178	162
9.5	179	155
10.5	180	157
11.5	182	163
12.5	183	168
13.5	186	173
14.5	187	176
15.5	190	181
16	191	179
16.5	193	184
17.5	196	187
18.5	197	183
19.5	199	187
20	199	187
21	200	174
21.5	200	185
22	202	189

Total (lbs) LAN Charged = **5713**
Total Overhead Recovered (lbs) = **883**
% Overhead Recovered = **15.46**
Total (lbs) Bottoms Recovered = **4801**
% Bottoms Recovered = **84.03**

% Total Recovered (Overhead + Bottom) = 99.49

Chart 1

PPSC LAN Vapor Generation

Run 1

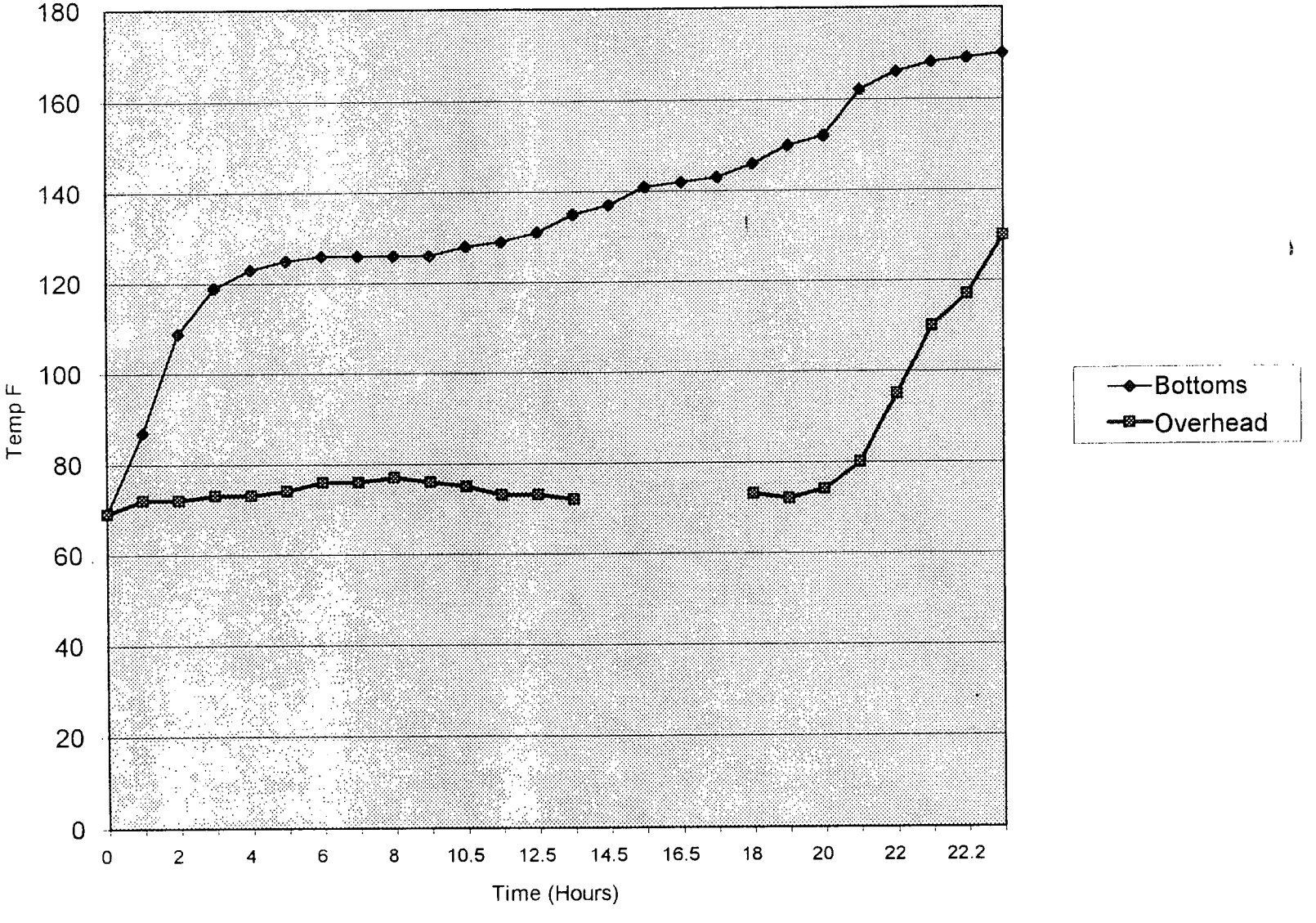

Chart 2

PPSC LAN Vapor Generation

Run 2

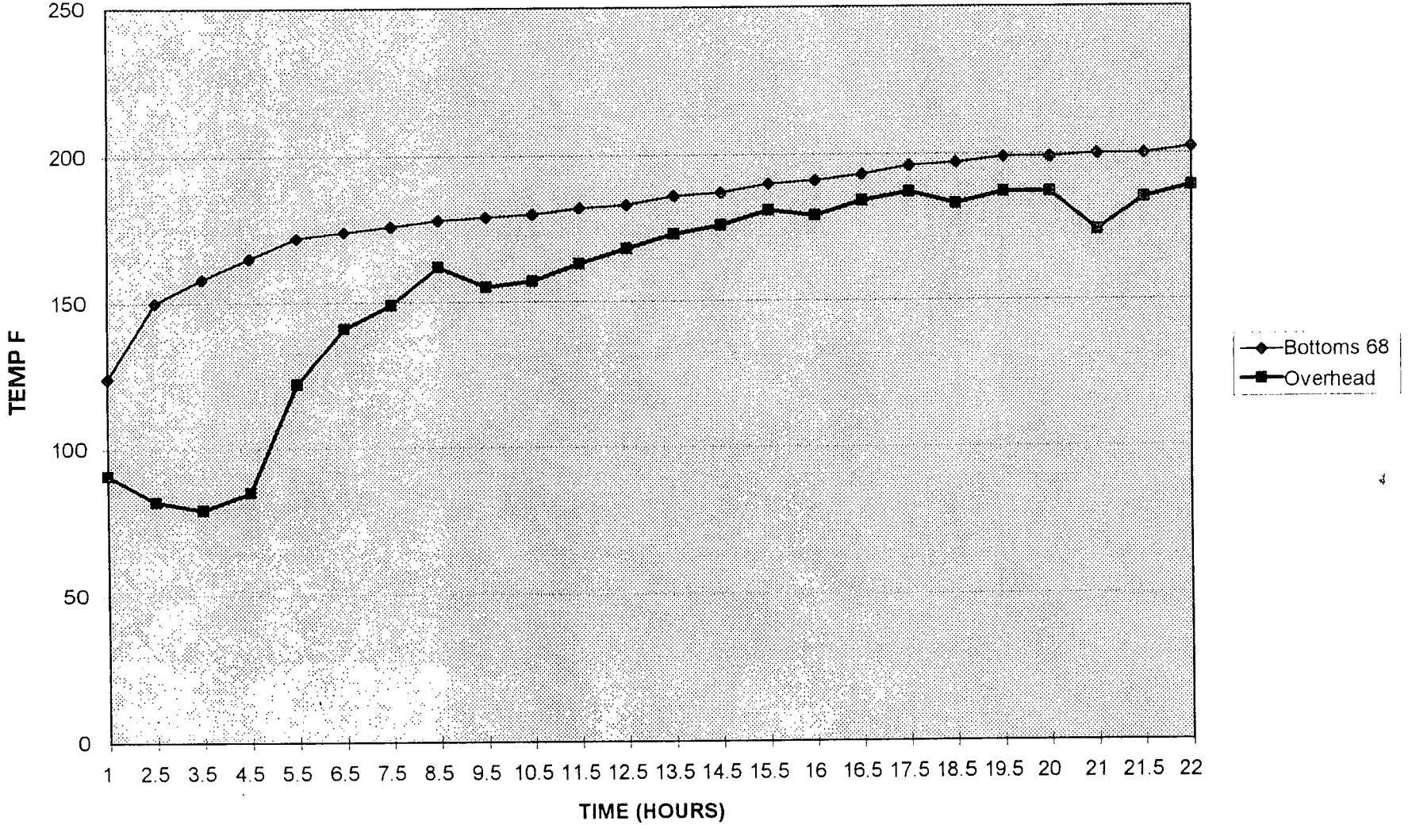

Table 2

PPSC Light Alkylate Naphtha

Full Scale Sample Preparations

Sample	LAN 1	LAND 1	LAN 2	LAND 2
Vapor Temperature		Distill 145F		190 F
Fraction	Liquid	20.64%	Liquid	15.46%
RVP	6	18.1	4.4	12.2
Composition Vol%				
N-Paraffins	1.27	5.06	0.71	3.47
Total Paraffins	89.59	99.91	99.75	99.97
Napthenes	9.78	0	0.03	0
Total Olefins	0	0.09	0	0.03
Total Aromatics	0.08	0	0	0
Benzene	0	0	0	0

Table 3

PPSC Light Alkylate Naphtha
Full Scale Sample Preparations

Sample	LAN 1	LAND 1	LAN 2	LAND 2
Vapor Temperature		Distill-145F		190 F
Fraction	Liquid	20.64%	Liquid	15.46%
RVP	6	18.6	4.4	12.2
Compounds Vol%				
n-butane	1	3.96	0.65	3.23
isobutane	0	0	0	0.02
2-butene (cis)	0	0	0	0
2-butene (trans)	0	0	0	0
n-pentane	0.27	1.37	0.06	0.24
isopentane	13.87	68.01	8.03	32.98
cyclopentane	0	0	0	0
1-pentene	0	0	0	0
2-pentene (trans)	0	0	0	0
2-pentene (cis)	0	0	0	0
3-methyl-1-butene	0	0	0	0
2-methyl-2-butene	0	0	0	0.02
2-methyl-1-butene	0	0	0	0.02
n-hexane	0	0	0	0
methylcyclopentane	0	0	0	0
cyclohexane	0	0	0	0
2,2-dimethylbutane	0	0	0	
2,3-dimethylbutane	4.93	18.81	5.12	12.97
2-methylpentane	1.68	5.56	1.73	4.13
3-methylpentane	0.8	1.98	0.81	1.81
2-methyl-2-pentene	0	0	0	0
2-methyl-1-pentene	0	0	0	0
1-hexene	0	0	0	0
2-hexene (cis)	0	0	0	0
benzene	0	0	0	0
n-heptane	0	0	0	0
1-heptene	0	0	0	0
2-methylhexane	0.53	0	0.53	0.51
3-methylhexane	0.35	0	0.35	0.32
methylcyclohexane	0	0	0	0
toluene	0	0	0	0
n-octane	0	0	0	0
2-methylheptane	0.39	0	0.34	0.12
3-methylheptane	0.13	0	0.12	0.04
2,2,4-trimethylpentane	23.77	0	23.73	16.82
2,3,4-trimethylpentane	11.19	0	11.34	4.65
2,4-dimethylhexane	3.33	0	3.49	1.72
2,5-dimethylhexane	4.42	0	4.27	2.1
ethylbenzene	0	0	0	0
p-xylene	0	0	0	0
o-xylene	0	0	0	0
m-xylene	0	0	0	0
TOTALS (%)	**66.66**	**99.69**	**60.57**	**81.7**

TASK ORDER 5

Pursuant to the "Master Study Agreement for Toxicological Research Programs "between the Petroleum Product Stewardship Council and Chevron Research and Technology company, dated January 14, 1994, the parties hereby commission the following work:

Deliverables: 1) Acquisition of 800 gallons of Light Alkylate Naphtha (CAS 64741-66-8) and analytical characterization including D519 vapor pressure, D86 boiling curve, D2622 sulfur, D5291 nitrogen, D56 flash point, and SE-30 gas chromatography analysis. 2) Conduct a 130F vapor generation and collection according to the procedures below. 3) Analytical characterization (SE-30) of the distillate. 4) Ship vapor condensate in 5 gallon DOT approved container as directed by PPSC.

General Procedures: Vapor generation of the LAN sample will be conducted using a 1000 gallon glass lined Pfaudler kettle. Eight hundred gallons of LAN, charged by weight, will be stirred and slowly heated until the vapor temperature reaches 130 F. The temperature of the liquid and vapor phase will be constantly monitored and recorded. The vapor will be condensed by passing through a chilled overhead collection system consisting of a 200 gallon primary receiving vessel chilled with water and 55 gallon secondary receiving vessels chilled with dry ice. The kettle and overhead system will be operated as a closed system. The vapor copndensate will be uniformly mixed and while chilled, transferred to 5 gallon containers for shipping.

Time Table: All deliverables are to be completed by December 30, 1994. Copies of the data will be sent to PPSC as soon as available.

Payment Schedule: Payment of $ 16,700 is due upon receipt of invoice submitted after the vapor condensate is shipped. (Sample acquisition $1,000, Analytical costs $700, kettle operation $12,000, Containers and shipping estimate $2,000, Project management, $1,000)

Study Director: Russell White
Study Monitor: Francis Koschier

SPONSOR

By: _____

Charles R. Clark
Petroleum Product
Stewardship Council

Date: _____

CONTRACTOR

By: _____

John C. Sebastian
Chevron Research and
Technology Company

Date: November 23, 1994

APPENDIX A

VAPOR GENERATION FROM LIGHT ALKYLATE NAPHTHA

WHOLE SAMPLE ANALYTICAL RESULTS

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 5000187 500-319 PPSC LT TANK ALK NAPTHA Customer: MC HENLEY
Acquisition Date: 5-Jan-1995 Acquisition Time: 23:40
Channel #: 6 Analysis: GASO526 Sample #: 5 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.65	0.00	******	******	******	0.65	0.65	0.00	******	******	******
5	8.09	0.00	0.00	******	******	8.09	0.06	8.03	******	0.00	******
6	7.66	0.00	0.00	0.00	******	7.66	0.00	7.66	******	0.00	0.00
7	8.38	0.00	0.00	0.00	******	8.38	0.00	8.38	******	0.00	0.00
8	56.76	0.00	0.00	0.00	0.00	56.76	0.00	8.59	48.17	0.00	0.00
9	12.39	0.00	0.03	0.00	0.02	12.44	0.00	1.80	10.59	0.00	0.03
10	5.58	0.00	0.00	0.00	0.18	5.76	0.00	1.34	4.24	0.00	0.00
11	0.24	0.00	0.00	0.00	0.02	0.26	0.00	0.02	0.22	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.75	0.00	0.03	0.00	0.22	100.00	0.71	35.82	63.22	0.00	0.03

2. BY WEIGHT

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	0.54	0.00	******	******	******	0.54	0.54	0.00	******	******	******
5	7.23	0.00	0.00	******	******	7.23	0.05	7.18	******	0.00	******
6	7.28	0.00	0.00	0.00	******	7.28	0.00	7.28	******	0.00	0.00
7	8.22	0.00	0.00	0.00	******	8.22	0.00	8.22	******	0.00	0.00
8	57.61	0.00	0.00	0.00	0.00	57.61	0.00	8.62	48.99	0.00	0.00
9	12.76	0.00	0.03	0.00	0.03	12.82	0.00	1.87	10.89	0.00	0.03
10	5.83	0.00	0.00	0.00	0.20	6.03	0.00	1.39	4.44	0.00	0.00
11	0.25	0.00	0.00	0.00	0.02	0.27	0.00	0.02	0.23	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.72	0.00	0.03	0.00	0.24	100.00	0.59	34.58	64.55	0.00	0.03

3. BY MOLAR

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	1.01	0.00	******	******	******	1.01	1.01	0.00	******	******	******
5	10.84	0.00	0.00	******	******	10.84	0.08	10.76	******	0.00	******
6	9.14	0.00	0.00	0.00	******	9.14	0.00	9.14	******	0.00	0.00
7	8.87	0.00	0.00	0.00	******	8.87	0.00	8.87	******	0.00	0.00
8	54.55	0.00	0.00	0.00	0.00	54.55	0.00	8.16	46.39	0.00	0.00
9	10.76	0.00	0.03	0.00	0.02	10.81	0.00	1.58	9.18	0.00	0.03
10	4.43	0.00	0.00	0.00	0.15	4.59	0.00	1.05	3.38	0.00	0.00
11	0.17	0.00	0.00	0.00	0.01	0.19	0.00	0.01	0.16	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.78	0.00	0.03	0.00	0.19	100.00	1.09	39.59	59.11	0.00	0.03

GRP. TYPE, VOL %: P = 99.97, O = 0.00, N = 0.03, A = 0.00, Saturates =100.00
DIENE CONTENT = 0. vol ppm AVG MW =108.2 API GR. = 71.0 SP. GR. =0.6989
OCTANE NUMBER: (from pure values) RON = 90.2 MON = 88.2
(from blending values) RON = 87.8 MON = 85.0
CARBON-HYDROGEN RATIO =5.263 STOICH. AIR-FUEL RATIO =15.12 lbs air/lbs fuel
BTU/lb = 19143. NET, 20234. GROSS; BTU/gal =111653. NET, 118017. GROSS
REID VAPOR PRESSURE = 4.4 BROMINE NO. = 0.0

5-Jan-1995 23:40
5000187 500-319 PPSC LT TANK ALK NAPTHA 6GASO526
Sample 5 Injection 1

* DISTILLATION CURVES

VOL %	TBP	D86
0.	31.	136.
5.	82.	177.
10.	136.	194.
15.	140.	210.
20.	177.	210.
25.	211.	210.
30.	211.	210.
35.	211.	210.
40.	211.	210.
45.	211.	228.
50.	228.	228.
55.	229.	229.
60.	236.	236.
65.	236.	236.
70.	239.	238.
75.	239.	238.
80.	240.	243.
85.	255.	254.
90.	255.	266.
95.	289.	295.
100.	374.	314.

CHEVRON RESEARCH GASOLINE ANALYSIS
5-Jan-1995 23:40
5000187 500-319 PPSC LT TANK ALK NAPTHA 6GASO526
Sample 5 Injection 1

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
4	1.01	0.65	0.54	N-BUTANE	
6	0.08	0.06	0.05	N-PENTANE	

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
7	10.76	8.03	7.18	ISOPENTANE	
13	6.12	5.12	4.88	23-DIME BUTANE	
10	2.05	1.73	1.63	2-ME PENTANE	
11	0.97	0.81	0.78	3-ME PENTANE	
20	4.85	4.64	4.50	24-DIME PENTANE	
19	3.09	2.86	2.87	23-DIME PENTANE	
15	0.55	0.53	0.51	2-ME HEXANE	
16	0.37	0.35	0.35	3-ME HEXANE	
37	22.38	23.73	23.63	224-TRIME PENTANE	*
36	1.66	1.71	1.76	223-TRIME PENTANE	*
31	4.04	4.27	4.26	25-DIME HEXANE	
30	3.34	3.49	3.52	24-DIME HEXANE	
38	8.66	8.75	9.14	233-TRIME PENTANE	*
39	11.11	11.34	11.74	234-TRIME PENTANE	*
29	2.57	2.65	2.71	23-DIME HEXANE	*
24	0.32	0.34	0.34	2-ME HEPTANE	
26	0.35	0.36	0.37	4-ME HEPTANE	
25	0.12	0.12	0.12	3-ME HEPTANE	
42	8.03	9.27	9.52	225-TRIME HEXANE	*
73	0.07	0.08	0.09	224-TRIME HEXANE	
51	0.17	0.19	0.20	244-TRIME HEXANE	
43	1.16	1.32	1.37	235-TRIME HEXANE	*
52	0.14	0.17	0.17	24-DIME HEPTANE	
53	0.24	0.28	0.29	26-DIME HEPTANE	
59	0.04	0.05	0.05	44-DIME HEPTANE	
55	0.52	0.60	0.62	35-DIME HEPTANE	
74	0.07	0.07	0.08	233-TRIME HEXANE	
50	0.04	0.04	0.04	234-TRIME HEXANE	
56	0.12	0.14	0.14	23-DIME HEPTANE	
71	0.02	0.02	0.02	3-ME-4-ET HEXANE	
57	0.02	0.03	0.03	34-DIME HEPTANE	
60	0.01	0.01	0.01	2-ME OCTANE	
4660	0.27	0.34	0.35	246-TRIME HEPTANE	*
76	0.11	0.12	0.12	33-DIET PENTANE	
4651	0.25	0.31	0.33	224-TRIME HEPTANE	*
4658	0.77	0.97	1.02	244-TRIME HEPTANE	*
4652	0.71	0.89	0.93	225-TRIME HEPTANE	*
4661	0.48	0.60	0.64	255-TRIME HEPTANE	*
4657	0.29	0.36	0.38	236-TRIME HEPTANE	*
4659	0.06	0.08	0.08	245-TRIME HEPTANE	*
151	0.02	0.02	0.02	22-DIME OCTANE	
4650	0.04	0.05	0.06	223-TRIME HEPTANE	*

5001	0.08	0.10	0.10	C-10 ISOPARAFFIN O
155	0.04	0.05	0.05	26-DIME OCTANE
5004	0.02	0.02	0.03	2-ME-3-ET HEPTANE
152	0.01	0.02	0.02	23-DIME OCTANE
5003	0.89	1.13	1.17	C-10 ISOPARAFFIN P
4675	0.12	0.16	0.16	C-10 ISOPAR ALKY A *
4676	0.12	0.16	0.16	C-10 ISOPAR ALKY B *
4677	0.16	0.20	0.21	C-10 ISOPAR ALKY C *
4678	0.07	0.09	0.10	C-10 ISOPAR ALKY D *
4663	0.02	0.03	0.03	335-TRIME HEPTANE *
216	0.09	0.12	0.12	C-11 ISOPARAF ALKY *
216	0.02	0.03	0.03	C-11 ISOPARAF ALKY *
216	0.04	0.06	0.06	C-11 ISOPARAF ALKY *
216	0.02	0.02	0.02	C-11 ISOPARAF ALKY *
164	0.01	0.02	0.02	3-ME DECANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
946	0.03	0.03	0.03	113-TRIME CYCHEXANE

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
189	0.02	0.02	0.03	UNCLASS. H.C. C- 9
190	0.03	0.03	0.03	UNCLASS. H.C. C-10
190	0.02	0.02	0.03	UNCLASS. H.C. C-10
190	0.03	0.04	0.04	UNCLASS. H.C. C-10
190	0.08	0.09	0.10	UNCLASS. H.C. C-10
191	0.01	0.02	0.02	UNCLASS. H.C. C-11

5000186 500-319 PPSC LT ALK NAPTHA TT14364 REGULAR SERVICE
REPORTED 12-Jan-95 Marked-up: 3-Jan-95 by TWGBR at 51-2124
HENLEY, M. C. (1176/0)

Test code	Test Name/Element/Result	Test Status	Analyst	Status date	Test Cost
11111	D86 DIST. UPLOAD	REPORTED	TALET	12-Jan-95	$40.00

05ML	158.0 DEG F	10ML	175.8 DEG F	20ML	194.5 DEG F
30ML	208.9 DEG F	40ML	217.7 DEG F	50ML	223.7 DEG F
60ML	228.3 DEG F	70ML	233.7 DEG F	80ML	240.2 DEG F
90ML	252.6 DEG F	95ML	272.8 DEG F	EPT	321.0 DEG F
EPVOL	98.3 VOL %	EV05ML	154.7 DEG F	EV10ML	174.5 DEG F
EV20ML	193.6 DEG F	EV30ML	208.2 DEG F	EV40ML	217.2 DEG F
EV50ML	223.5 DEG F	EV60ML	228.2 DEG F	EV70ML	233.4 DEG F
EV80ML	239.7 DEG F	EV90ML	251.6 DEG F	EV95ML	269.4 DEG F
EVEPT	321.0 DEG F	EVEPVL	98.8 VOL %	EVIBP	93.7 DEG F
IBP	93.7 DEG F	LOSS	0.5 VOL %	RECVRY	98.5 VOL %
RESID	1.0 VOL %				

*** End of Report ***

APPENDIX B

VAPOR GENERATION FROM LIGHT ALKYLATE NAPHTHA

DISTILLATE ANALYTICAL RESULTS

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 5000608 500-319 ST-190 OVHDS Customer: MC HENLEY
Acquisition Date: 5-Jan-1995 PPSC LAW Acquisition Time: 21:28
Channel #: 6 Analysis: GAS0526 Sample #: 4 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	3.25	0.00	******	******	******	3.25	3.23	0.02	******	******	******
5	33.26	0.03	0.00	******	******	33.30	0.24	33.02	******	0.00	******
6	18.91	0.00	0.00	0.00	******	18.91	0.00	18.91	******	0.00	0.00
7	9.81	0.00	0.00	0.00	******	9.81	0.00	9.81	******	0.00	0.00
8	31.14	0.00	0.00	0.00	0.00	31.14	0.00	4.09	27.05	0.00	0.00
9	3.21	0.00	0.00	0.00	0.00	3.21	0.00	0.26	2.94	0.00	0.00
10	0.39	0.00	0.00	0.00	0.00	0.39	0.00	0.06	0.33	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.97	0.03	0.00	0.00	0.00	100.00	3.47	66.17	30.32	0.00	0.00

2. BY WEIGHT

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	2.85	0.00	******	******	******	2.85	2.84	0.02	******	******	******
5	31.22	0.03	0.00	******	******	31.25	0.23	30.99	******	0.00	******
6	18.89	0.00	0.00	0.00	******	18.89	0.00	18.89	******	0.00	0.00
7	10.08	0.00	0.00	0.00	******	10.08	0.00	10.08	******	0.00	0.00
8	33.04	0.00	0.00	0.00	0.00	33.04	0.00	4.31	28.73	0.00	0.00
9	3.46	0.00	0.00	0.00	0.00	3.46	0.00	0.29	3.17	0.00	0.00
10	0.43	0.00	0.00	0.00	0.00	0.43	0.00	0.06	0.37	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.97	0.03	0.00	0.00	0.00	100.00	3.06	64.63	32.27	0.00	0.00

3. BY MOLAR

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	******
4	4.38	0.00	******	******	******	4.38	4.35	0.03	******	******	******
5	38.59	0.04	0.00	******	******	38.63	0.28	38.31	******	0.00	******
6	19.55	0.00	0.00	0.00	******	19.55	0.00	19.55	******	0.00	0.00
7	8.97	0.00	0.00	0.00	******	8.97	0.00	8.97	******	0.00	0.00
8	25.80	0.00	0.00	0.00	0.00	25.80	0.00	3.36	22.43	0.00	0.00
9	2.41	0.00	0.00	0.00	0.00	2.41	0.00	0.20	2.21	0.00	0.00
10	0.27	0.00	0.00	0.00	0.00	0.27	0.00	0.04	0.23	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	99.96	0.04	0.00	0.00	0.00	100.00	4.63	70.46	24.87	0.00	0.00

GRP. TYPE, VOL %: P = 99.97, O = 0.03, N = 0.00, A = 0.00, Saturates = 99.97
DIENE CONTENT = 0. vol ppm AVG MW = 89.2 API GR. = 81.1 SP. GR. =0.6656
OCTANE NUMBER: (from pure values) RON = 92.2 MON = 89.6
(from blending values) RON = 89.8 MON = 87.0
CARBON-HYDROGEN RATIO =5.132 STOICH. AIR-FUEL RATIO =15.20 lbs air/lbs fuel
BTU/lb = 19217. NET, 20555. GROSS; BTU/gal =106746. NET, 114177. GROSS
REID VAPOR PRESSURE =12.2 BROMINE NO. = 0.1

* DISTILLATION CURVES

VOL %	TBP	D86
0.	11.	82.
5.	82.	82.
10.	82.	82.
15.	82.	82.
20.	82.	82.
25.	82.	82.
30.	82.	136.
35.	82.	136.
40.	136.	136.
45.	136.	136.
50.	140.	140.
55.	146.	177.
60.	177.	194.
65.	197.	210.
70.	211.	210.
75.	211.	210.
80.	211.	210.
85.	229.	229.
90.	236.	236.
95.	239.	239.
100.	317.	273.

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	4.35	3.23	2.84	N-BUTANE
6	0.28	0.24	0.23	N-PENTANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	0.03	0.02	0.02	ISOBUTANE	
8	0.04	0.04	0.04	NEOPENTANE	
7	38.26	32.98	30.95	ISOPENTANE	
13	13.44	12.97	12.99	23-DIME BUTANE	
10	4.23	4.13	4.08	2-ME PENTANE	
11	1.88	1.81	1.82	3-ME PENTANE	
20	5.60	6.18	6.29	24-DIME PENTANE	
19	2.61	2.79	2.94	23-DIME PENTANE	
15	0.47	0.51	0.53	2-ME HEXANE	
16	0.29	0.32	0.33	3-ME HEXANE	
37	13.74	16.82	17.59	224-TRIME PENTANE	*
36	0.68	0.81	0.88	223-TRIME PENTANE	*
31	1.72	2.10	2.20	25-DIME HEXANE	
30	1.42	1.72	1.82	24-DIME HEXANE	
38	3.22	3.76	4.12	233-TRIME PENTANE	*
39	3.95	4.65	5.05	234-TRIME PENTANE	*
29	0.85	1.01	1.08	23-DIME HEXANE	*
24	0.10	0.12	0.12	2-ME HEPTANE	
26	0.10	0.12	0.13	4-ME HEPTANE	
25	0.03	0.04	0.04	3-ME HEPTANE	
42	2.00	2.67	2.88	225-TRIME HEXANE	*
73	0.01	0.02	0.02	224-TRIME HEXANE	
51	0.03	0.04	0.04	244-TRIME HEXANE	
43	0.20	0.27	0.29	235-TRIME HEXANE	*
52	0.02	0.03	0.03	24-DIME HEPTANE	
53	0.04	0.05	0.05	26-DIME HEPTANE	
55	0.08	0.11	0.12	35-DIME HEPTANE	
56	0.01	0.02	0.02	23-DIME HEPTANE	
4660	0.03	0.04	0.04	246-TRIME HEPTANE	*
4651	0.02	0.03	0.03	224-TRIME HEPTANE	*
4658	0.07	0.10	0.11	244-TRIME HEPTANE	*
4652	0.06	0.09	0.10	225-TRIME HEPTANE	*
4661	0.04	0.05	0.06	255-TRIME HEPTANE	*
4657	0.02	0.02	0.03	236-TRIME HEPTANE	*
5003	0.04	0.06	0.06	C-10 ISOPARAFFIN P	

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
310	0.02	0.02	0.02	3-METHYL-1-BUTENE
309	0.02	0.02	0.02	2-METHYL-1-BUTENE

API Unleaded Gasoline Samples

unleaded
PS-6 Gasoline

CONSCI

American Petroleum Institute
1220 L Street Northwest
Washington D.C., 20005

January 13, 1994

Attn: Chris Sexsmith

Invoice #: 31207009

Certificate #: 31214002
Sample ID: PS-6 Gasoline
Date Received: December 14, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
Propane	0.02	0.03
Isobutane	0.60	0.79
Isobutylene + 1-Butene	0.09	0.11
n-Butane	3.05	3.82
trans-2-Butene	0.16	0.19
cis-2-Butene	0.17	0.20
3-Methyl-1-butene	0.06	0.07
Isopentane	7.95	9.40
1-Pentene	0.18	0.21
2-Methyl-1-butene	0.40	0.45
n-Pentane	3.29	3.85
trans-2-Pentene	0.51	0.58
3,3-Dimethyl-1-butene	0.84	0.94
cis-2-Pentene	0.29	0.32
2,2-Dimethylbutane + Cyclopentadiene + cis-1,3-Pentadiene	0.00	0.00
Cyclopentene	0.08	0.08
4-Methyl-1-pentene	0.03	0.03
3-Methyl-1-pentene	0.05	0.06
Cyclopentane	0.24	0.24
2,3-Dimethylbutane	1.84	2.04
2,3-Dimethyl-1-butene	0.09	0.10
4-Methyl-cis-2-pentene	0.09	0.10
2-Methylpentane	4.04	4.54

American Petroleum Institute
Certificate #: 31214002
Sample ID: PS-6 Gasoline
Date Received: December 14, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
4-Methyl-trans-2-pentene	2.37	2.60
2-Methyl-1-pentene	0.12	0.13
1-Hexene	0.12	0.13
n-Hexane + 2-Ethyl-1-butene	1.71	1.90
cis-3-Hexene	0.10	0.11
trans-3-Hexene	0.04	0.04
trans-2-Hexene	0.21	0.23
2-Methyl-2-pentene	0.26	0.28
3-Methyl-cis-2-pentene	0.21	0.22
4-Methylcyclopentene	0.02	0.02
3-Methyl-trans-2-pentene	0.12	0.13
cis-2-Hexene	0.26	0.28
2,2-Dimethylpentane	0.05	0.05
Methylcyclopentane	1.12	1.10
2,4-Dimethylpentane	1.01	1.10
2,2,3-Trimethyl-1-butene	0.01	0.01
2,2,3-Trimethylbutane	0.07	0.07
1-Methylcyclopentene	0.16	0.15
C7 Olefin	0.02	0.02
Benzene	2.12	1.77
3,3-Dimethylpentane + C7 olefin	0.07	0.07
Cyclohexane + C7 olefin	0.14	0.13
C7 Cyclo-olefin/diolefin	0.02	0.02
C7 Olefin	0.03	0.03
2-Methylhexane	1.56	1.69
2,3-Dimethylpentane + C7 olefin	0.84	0.89
1,1-Dimethylcyclopentane	0.02	0.02
3-Methylhexane	1.50	1.60
C7 Olefin	0.03	0.03
t-1,3-Dimethylcyclopentane	0.31	0.30
c-1,3-Dimethylcyclopentane	0.27	0.27
3-Ethylpentane + C7 olefin	0.15	0.16
t-1,2-Dimethylcyclopentane	0.19	0.19
2,2,4-Trimethylpentane	5.73	6.08

American Petroleum Institute
Certificate #: 31214002
Sample ID: PS-6 Gasoline
Date Received: December 14, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
C7 Olefin	0.04	0.04
C7 Olefin	0.07	0.07
n-Heptane	0.62	0.67
C7 Olefin	0.06	0.06
C7 Olefin	0.14	0.15
C7 Olefin	0.06	0.06
C7 Olefin	0.06	0.06
C7 Olefin	0.04	0.04
C7 Olefin	0.08	0.08
C8 Olefin	0.04	0.04
C8 Olefin	0.04	0.04
C8 Olefin	0.03	0.03
C8 Olefin	0.02	0.02
c-1,2-Dimethylcyclopentane	0.16	0.15
Methylcyclohexane	0.35	0.33
2,2-Dimethylhexane	0.03	0.03
C8 Cyclo-olefin/diolefin	0.06	0.06
C8 Cyclo-olefin/diolefin	0.01	0.01
Ethylcyclopentane + 2,5-Dimethylhexane	1.20	1.21
2,2,3-Trimethylpentane + C8 olefin + 2,4-Dimethylhexane	1.24	1.29
1,2,4-Trimethylcyclopentane	0.11	0.11
3,3-Dimethylhexane	0.03	0.03
C8 Olefin	0.01	0.01
1,2,3-Trimethylcyclopentane + C8 Cyclo-olefin/diolefin	0.04	0.04
2,3,4-Trimethylpentane + C8 olefin	3.40	3.47
2,3,3-Trimethylpentane + C8 olefin	3.57	3.61
Toluene	3.97	3.36
2,3-Dimethylhexane + C8 olefin	0.90	0.93
1-Methyl-1-ethylpentane	0.08	0.08
C8 Olefin	0.02	0.02
2-Methylheptane	0.68	0.72

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
4-Methylheptane	0.27	0.28
3-Methyl-3-ethylpentane + C8 olefin	0.18	0.18
3-Methylheptane	0.81	0.84
3-Ethylhexane + C8 olefin	0.13	0.13
c-1,4-Dimethylcyclohexane	0.08	0.08
t-1,4-Dimethylcyclohexane	0.06	0.06
C8 Naphthene + C8 olefin	0.05	0.05
C8 Naphthene + C8 olefin	0.01	0.01
C8 Naphthene + C8 olefin	0.06	0.06
C8 Naphthene + C8 olefin	0.02	0.02
2,2,4-Trimethylhexane	0.74	0.76
C8 Naphthene	0.12	0.12
C8 Naphthene	0.09	0.09
Unidentified C8's	0.12	0.12
n-Octane	0.37	0.39
t-1,2-Dimethylcyclohexane	0.01	0.01
1,2,3-Trimethylcyclopentane	0.10	0.09
C8 Olefin	0.02	0.02
C8 Olefin	0.01	0.01
C8 Olefin + C9 olefin	0.04	0.04
C9 Naphthene	0.01	0.01
C9 Paraffin + C8 olefin	0.13	0.13
Diolefin	0.06	0.06
C8 Olefin	0.01	0.01
C8 Olefin	0.02	0.02
C9 Paraffin	0.09	0.09
Olefin	0.04	0.04
c-1,2-Dimethylcyclohexane + C9 olefin	0.04	0.04
C9 Paraffin	0.16	0.16
Ethylcyclohexane	0.02	0.02
C9 Paraffin	0.22	0.22
C9 Paraffin	0.01	0.01
1,3,5-Trimethylcyclohexane + C9 olefin	0.01	0.01
C9 Naphthene	0.01	0.01

American Petroleum Institute
Certificate #: 31214002
Sample ID: PS-6 Gasoline
Date Received: December 14, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
C9 Naphthene + C9 olefin	0.01	0.01
Ethylbenzene	1.87	1.58
C9 Olefin	0.04	0.04
m-Xylene + C9 paraffin	5.03	4.28
p-Xylene + C9 paraffin	1.96	1.67
3,4-Dimethylheptane	0.04	0.04
2-Methyloctane	0.22	0.23
4-Methyloctane	0.31	0.32
3-Ethyloctane	0.20	0.16
3-Methyloctane	0.31	0.32
3,3-Diethylpentane	0.07	0.07
o-Xylene	2.45	2.05
C10 Naphthene	0.11	0.10
Naphthene	0.02	0.02
Naphthene	0.05	0.05
Paraffin	0.09	0.08
Naphthene	0.01	0.01
Unidentified C9's	0.07	0.07
n-Nonane	0.19	0.19
C9 Naphthene	0.05	0.05
Isopropylbenzene	0.11	0.09
C9 Naphthene	0.02	0.02
Paraffin	0.04	0.04
C10 Paraffin	0.04	0.04
C10 Paraffin	0.01	0.01
C10 Paraffin	0.05	0.05
C10 Paraffin	0.01	0.01
C10 Naphthene	0.02	0.02
C10 Paraffin	0.00	0.00
3,3-Dimethyloctane	0.07	0.07
n-Propylbenzene	0.54	0.46
1-Methyl-3-ethylbenzene	2.02	1.72
1-Methyl-4-ethylbenzene	0.89	0.76
C10 Paraffin	0.02	0.02

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
1,3,5-Trimethylbenzene	1.13	0.96
4-Methylnonane	0.15	0.15
2-Methylnonane	0.12	0.12
Paraffin	0.23	0.23
1-Methyl-2-ethylbenzene	0.62	0.52
3-Methylnonane	0.13	0.13
Paraffin	0.05	0.04
Paraffin	0.02	0.02
1,2,4-Trimethylbenzene	3.36	2.82
Naphthene + olefin	0.03	0.03
Paraffin	0.02	0.02
C10 Aromatic	0.04	0.03
Unidentified C10's	0.11	0.11
n-Decane	0.18	0.18
iso-Butylbenzene	0.02	0.02
Paraffin	0.01	0.01
1,2,3-Trimethylbenzene + C10 Styrene	0.59	0.49
C11 Paraffin	0.02	0.02
C11 Paraffin	0.07	0.06
Indane	0.28	0.21
C11 Paraffin	0.14	0.14
Paraffin	0.18	0.17
C11 Paraffin	0.37	0.36
1,3-Diethylbenzene	0.14	0.12
1-Methyl-3-n-propylbenzene	0.25	0.21
1-Methyl-4-n-propylbenzene	0.22	0.19
n-Butylbenzene	0.08	0.07
1,2-Diethylbenzene	0.40	0.33
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.01	0.01
C11 Paraffin	0.04	0.04
C11 Paraffin	0.30	0.30
C11 Paraffin	0.01	0.01
Paraffin	0.12	0.10

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
C11 Paraffin	0.14	0.14
1,3-Dimethyl-4-ethylbenzene + Indane	0.36	0.30
Paraffin	0.15	0.12
1,2-Dimethyl-4-ethylbenzene + Indane	0.52	0.44
Paraffin	0.16	0.13
Paraffin	0.01	0.01
Paraffin	0.02	0.02
C11 Aromatic	0.02	0.02
Unidentified C11's	0.07	0.07
1,2-Dimethyl-3-ethylbenzene	0.13	0.11
n-Undecane	0.15	0.15
Aromatic	0.01	0.01
1,2,4,5-Tetramethylbenzene	0.26	0.22
1,2,3,5-Tetramethylbenzene	0.37	0.31
Unidentified C12's	0.09	0.09
Dodecane	0.21	0.20
C12 Paraffins	0.17	0.17
C10 Indanes	0.44	0.36
Naphthalene	0.39	0.24
C11 Indanes	0.61	0.50
C13 Paraffins	0.25	0.24
Tridecane	0.24	0.23
C12 Aromatics	1.00	0.86
C12 Indanes	0.05	0.04
C14+ Paraffins	0.23	0.22
Methylnaphthalenes	0.83	0.61
C13+ Aromatics	0.21	0.18
Dimethylnaphthalenes	0.22	0.16
Unidentified Heavies	0.00	0.00
Totals	100.00	100.00

		Wt%	LV%
Paraffins		53.02	57.80
Naphthenes		4.01	3.91
Aromatics		33.52	28.08
Olefins		9.12	9.88
Unknowns		0.33	0.33
Oxygenates		<0.01	<0.01
	Totals	100.00	100.00

Paul A. Radenheimer

PAR/ar

CONSCI

API 91-1A
Unleaded gasoline
Initial Analysis

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005

November 29, 1991

Attn: Chris Sexsmith

Invoice #: 97346
P.O. #: 76520

Certificate #: 11105008
Sample ID: Unleaded Gas(API 91-1),10/24/91
Date Received: November 5, 1991

CERTIFICATE OF ANALYSIS

Component Name	WT %	LV %
Propane	0.01	0.01
Isobutane	0.14	0.19
n-Butane	4.88	6.24
1,2-Butadiene	0.03	0.03
3-Methyl-1-butene	0.03	0.04
Isopentane	4.51	5.39
1-Pentene	0.63	0.73
n-Pentane	3.61	4.27
2-Methyl-1,3-butadiene	0.01	0.01
trans-2-Pentene	0.73	0.83
cis-2-Pentene	0.43	0.49
2-Methyl-2-butene	1.21	1.35
2,2-Dimethylbutane + Cyclopentadiene	1.01	1.15
Cyclopentene	0.17	0.16
4-Methyl-1-pentene	0.06	0.07
3-Methyl-1-pentene	0.08	0.09
Cyclopentane	0.23	0.23
2,3-Dimethylbutane	1.65	1.85
4-Methyl-cis-2-pentene	0.06	0.07
2-Methylpentane	5.52	6.27
4-Methyl-trans-2-pentene	0.04	0.04
3-Methylpentane	3.12	3.48
2-Methyl-1-pentene	0.28	0.31
1-Hexene	0.12	0.13

CERTIFICATE OF ANALYSIS

Component Name	WT %	LV %
n-Hexane + 2-Ethyl-1-butene	2.65	2.98
trans-3-Hexene	0.18	0.20
trans-2-Hexene	0.38	0.42
3-Methylcyclopentene	0.42	0.41
3-Methyl-cis-2-pentene	0.11	0.12
4-Methylcyclopentene	0.26	0.25
3-Methyl-trans-2-pentene	0.05	0.05
cis-2-Hexene	0.21	0.23
2,2-Dimethylpentane	0.43	0.47
Methylcyclopentane	1.11	1.10
2,4-Dimethylpentane	0.69	0.76
C6 Olefin,s	0.13	0.14
1-Methylcyclopentene	0.38	0.36
C7 Olefin	0.01	0.01
Benzene	1.22	1.03
3,3-Dimethylpentane + C7 olefin	0.14	0.15
Cyclohexane + C7 olefin	0.28	0.27
C7 Cyclo-olefin/diolefin	0.06	0.06
C7 Cyclo-olefin/diolefin	0.02	0.02
C7 Cyclo-olefin/diolefin	0.05	0.05
C7 Olefin	0.12	0.13
2-Methylhexane	1.63	1.78
2,3-Dimethylpentane + C7 olefin	1.30	1.39
1,1-Dimethylcyclopentane	0.04	0.04
C7 Cyclo-olefin/diolefin	0.05	0.05
3-Methylhexane	1.70	1.84
C7 Olefin	0.04	0.04
t-1,3-Dimethylcyclopentane	0.32	0.32
c-1,3-Dimethylcyclopentane	0.28	0.28
3-Ethylpentane + C7 olefin	0.47	0.50
t-1,2-Dimethylcyclopentane	1.76	1.74
2,2,4-Trimethylpentane + C7 olefin	0.21	0.23
C7 Olefin	0.11	0.12
n-Heptane	1.30	1.41
C7 Olefin	0.05	0.05
C7 Olefin	0.24	0.25
C7 Olefin	0.11	0.12
C7 Olefin	0.12	0.13
C7 Olefin	0.06	0.06
C7 Olefin	0.13	0.14
C8 Olefin	0.09	0.09

CERTIFICATE OF ANALYSIS

Component Name	WT %	LV %
C8 Olefin	0.09	0.09
C8 Olefin (2)	0.08	0.08
C8 Olefin	0.05	0.05
c-1,2-Dimethylcyclopentane	0.18	0.17
Methylcyclohexane	0.43	0.42
Ethylcyclopentane	0.46	0.46
2,2,3-Trimethylpentane + C8 olefin + 2,4-Dimethylpentane	0.55	0.58
C7 Cyclo-olefin/diolefin	0.12	0.12
C8 Olefin	0.06	0.06
1,2,3-Trimethylcyclopentane + C8 Cyclo-olefin/diolefin	0.10	0.10
C8 Cyclo-olefin/diolefin	0.02	0.02
2,3,4-Trimethylpentane + C8 olefin	0.73	0.75
Toluene + C8 olefin	7.68	6.58
2,3-Dimethylhexane + C8 olefin	0.41	0.43
C8 Olefin	0.11	0.11
C8 Olefin	0.07	0.07
2-Methylheptane	0.85	0.90
4-Methylheptane	0.36	0.38
C8 olefins	0.14	0.14
3-Methylheptane	0.02	0.02
3-Ethylhexane + C8 olefin	1.21	1.26
C8 Naphthene + C8 olefin	0.14	0.14
C8 Paraffin + C8 olefin	0.24	0.23
C8 Naphthene + C8 olefin	0.16	0.16
C8 Naphthene + C8 olefin	0.13	0.13
C8 Naphthene	0.09	0.09
C8 Naphthene	0.13	0.13
n-Octane + C8 olefin	0.65	0.69
t-1,2-Dimethylcyclohexane	0.12	0.11
C8 Olefin	0.05	0.05
C9 Naphthene	0.21	0.20
C9 Paraffin + C8 olefin	0.05	0.05
C8 Olefin	0.06	0.06
C9 Paraffin	0.19	0.19
c-1,2-Dimethylcyclohexane + C9 olefin	0.05	0.05
C9 Naphthene	0.14	0.13
C9 Paraffin	0.03	0.03
C9 Naphthene	0.06	0.06
C9 Naphthene + C9 olefin	0.25	0.24
C9 Naphthene	0.03	0.03
C9 Naphthene	0.02	0.02

CERTIFICATE OF ANALYSIS

Component Name	WT %	LV %
Ethylbenzene	3.37	2.89
C9 Naphthene	0.03	0.03
C8 Naphthene	0.01	0.01
m-Xylene + C9 paraffin	5.31	4.57
p-Xylene + C9 paraffin	2.13	1.84
C9 Olefins + C9 Paraffins	0.06	0.06
2-Methyloctane	0.28	0.29
4-Methyloctane	0.32	0.33
C9 Naphthene	0.02	0.02
C9 Olefin	0.01	0.01
3-Ethylheptane	0.07	0.07
3-Methyloctane	0.34	0.35
o-Xylene	2.64	2.23
C10 Naphthene	0.04	0.04
C9 Naphthene + C9 olefin	0.14	0.13
C10 Naphthene + C9 olefin	0.02	0.02
C9 Naphthene	0.07	0.07
C10 Naphthene + C9 olefin	0.03	0.03
C9 Olefin	0.03	0.03
n-Nonane	0.24	0.25
C9 Naphthene	0.02	0.02
C9 Naphthene	0.02	0.02
Isopropylbenzene + C9 Naphthene	0.22	0.19
C9 Naphthene	0.03	0.03
C10 Olefin	0.05	0.05
C10 Olefin	0.01	0.01
C10 Paraffin	0.02	0.02
C10 Olefin	0.05	0.05
Naphthene	0.02	0.02
C10 Naphthene	0.01	0.01
C10 Naphthene	0.03	0.03
Naphthene	0.02	0.02
C10 Naphthene	0.03	0.03
C10 Paraffin	0.06	0.06
n-Propylbenzene	0.75	0.65
1-Methyl-3-ethylbenzene	2.34	2.01
1-Methyl-4-ethylbenzene	1.06	1.07
C10 Paraffin	0.03	0.03
1,3,5-Trimethylbenzene + C10 paraffin	1.10	0.94
4-Methylnonane	0.11	0.11
2-Methylnonane	0.15	0.15
1-Methyl-2-ethylbenzene	0.72	0.61
3-Ethyloctane	0.12	0.12

CERTIFICATE OF ANALYSIS

Component Name	WT %	LV %
1,2,4-Trimethylbenzene	3.37	2.86
Unidentified C10's	0.06	0.06
n-Decane	0.09	0.09
1-Methyl-3-isopropylbenzene	0.06	0.05
1,2,3-Trimethylbenzene	0.68	0.57
1-Methyl-4-isopropylbenzene	0.02	0.02
C11 Paraffin	0.02	0.02
Indan	0.40	0.31
C11 Paraffin	0.05	0.05
Olefin	0.01	0.01
C11 Paraffin	0.03	0.03
1,3-Diethylbenzene	0.22	0.19
1-Methyl-3-n-propylbenzene	0.48	0.41
1-Methyl-4-n-propylbenzene	0.28	0.24
n-Butylbenzene	0.14	0.12
1,2-Diethylbenzene	0.44	0.37
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.04	0.03
C11 Paraffin	0.01	0.01
1-Methyl-2-n-propylbenzene	0.18	0.15
C11 Paraffin	0.04	0.04
C11 Paraffin	0.06	0.06
1,4-Dimethyl-2-ethylbenzene	0.28	0.24
1,3-Dimethyl-4-ethylbenzene	0.25	0.21
C11 Paraffin	0.13	0.13
1,2-Dimethyl-4-ethylbenzene + C10 indan	0.62	0.53
Unidentified C11's	0.12	0.12
1,2-Dimethyl-3-ethylbenzene	0.15	0.12
n-Undecane	0.06	0.06
1,2,4,5-Tetramethylbenzene	0.24	0.20
1,2,3,5-Tetramethylbenzene	0.33	0.28
C12 Paraffins	0.37	0.36
C11 Aromatics	0.32	0.27
C10/C11 Indans	0.09	0.07
Naphthalene	0.53	0.34
Unidentified C12's	0.19	0.19
n-Dodecane	0.05	0.05
C13 Paraffins	0.19	0.18
C12 Aromatics	1.06	0.88
C12 Indans	0.54	0.42
Methylnaphthalenes	0.69	0.45
Heavies	0.99	0.89
	100.00	100.00

Hydrocarbon Summary	WT %	LV %
n-Paraffins	13.58	16.04
Isoparaffins	27.43	30.34
Naphthenes	6.84	6.72
Aromatics	39.05	33.17
Olefins	11.74	12.47
Unknowns	1.36	1.26
Total	100.00	100.00

Reid Vapor Press.,PSI	8.5
MTBE,vl%	< 0.10
Methanol,vl%	< 0.10
Benzene,vl%	1.03
Bromine #	24
Research Octane No.	92.2
Motor Octane No.	82.5
R + M /2	87.4
Total Sulfur,ppm/wt	295
Carbon wt%	85.95
Hydrogen,wt%	13.00
Nitrogen,wt%	0.0083
Oxygen,wt%	0.74
Molecular Weight,(Calculated)	94.3

D-86 Distilation	
IBP/5	98/124
10/20	136/158
30/40	178/201
50/60	224/250
70/80	272/304
90/95	342/376
End Point	422
Recovered	98.0
Residue	1.0
Loss	1.0

Ben Miller

BHM/ar

CONSCI

API 91-1
Unleaded Gasoline
Post-Study
Analysis

January 13, 1994

American Petroleum Institute
1220 L Street Northwest
Washington, D.C., 20005

Attn: Chris Sexsmith

Invoice #: 31207009

Certificate #: 31207009
Sample ID: API 91-1 Gasoline
Date Received: December 7, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
Propane	0.01	0.01
Isobutane	0.10	0.13
n-Butane	3.96	5.08
2,2-Dimethylpropane	0.02	0.02
3-Methyl-1-butene	0.03	0.04
Isopentane	4.09	4.91
1-Pentene	0.18	0.21
2-Methyl-1-butene	0.39	0.45
n-Pentane	3.34	3.97
trans-2-Pentene	0.68	0.78
cis-2-Pentene	0.39	0.44
2-Methyl-2-butene	1.12	1.26
trans-1,3-Pentadiene	0.02	0.02
cis-1,3-Pentadiene	0.96	1.10
Cyclopentene	0.15	0.14
4-Methyl-1-pentene	0.05	0.06
3-Methyl-1-pentene	0.08	0.09
Cyclopentane	0.16	0.16
2,3-Dimethylbutane	1.66	1.87
2-Methylpentane	5.53	6.30
3-Methylpentane	3.07	3.44
2-Methyl-1-pentene	0.39	0.43
n-Hexane	2.63	2.97
cis-3-Hexene	0.18	0.20

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
trans-3-Hexene	0.07	0.08
trans-2-Hexene	0.36	0.40
2-Methyl-2-pentene	0.33	0.36
3-Methylcyclopentene	0.08	0.08
3-Methyl-cis-2-pentene	0.36	0.39
4-Methylcyclopentene	0.05	0.05
3-Methyl-trans-2-pentene	0.21	0.22
cis-2-Hexene	0.42	0.46
2,2-Dimethylpentane	0.08	0.09
Methylcyclopentane	1.09	1.08
2,4-Dimethylpentane	0.68	0.75
C7 Olefins + C7 Cyclo-olefin/diolefins	0.11	0.11
1-Methylcyclopentene	0.38	0.36
Benzene	1.22	1.03
3,3-Dimethylpentane	0.12	0.13
Cyclohexane	0.22	0.21
C7 Olefin	0.02	0.02
C7 Olefin	0.06	0.06
C7 Olefin	0.02	0.02
C7 Olefin	0.05	0.05
2-Methylhexane	1.78	1.95
2,3-Dimethylpentane	1.31	1.40
1,1-Dimethylcyclopentane	0.03	0.03
C7 Olefin	0.04	0.04
3-Methylhexane	1.76	1.91
C7 Olefin	0.04	0.04
t-1,3-Dimethylcyclopentane	0.32	0.32
c-1,3-Dimethylcyclopentane	0.28	0.28
3-Ethylpentane + C7 olefin	0.24	0.26
t-1,2-Dimethylcyclopentane	0.26	0.26
2,2,4-Trimethylpentane + C7 olefin	1.87	2.01
C7 Olefin	0.06	0.06
C7 Olefin	0.14	0.15

American Petroleum Institute
Certificate #: 31207009
Sample Description: API 91-1 Gasoline
Date Received: December 7, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
n-Heptane	1.36	1.48
C7 Olefin	0.14	0.15
C7 Olefin	0.25	0.26
C7 Olefin	0.11	0.12
C7 Olefin	0.13	0.14
C7 Olefin	0.06	0.06
C7 Olefin	0.13	0.14
Olefin	0.14	0.15
Olefin	0.07	0.07
Olefin	0.06	0.06
Olefin	0.01	0.01
Olefin	0.01	0.01
c-1,2-Dimethylcyclopentane	0.16	0.15
Methylcyclohexane	0.44	0.43
2,2-Dimethylhexane	0.06	0.06
1,1,3-Trimethylcyclopentane	0.07	0.07
Olefin	0.01	0.01
Olefin	0.03	0.03
Ethylcyclopentane + 2,5-Dimethylhexane	0.49	0.50
2,2,3-Trimethylpentane + 2,4-Dimethylhexane	0.57	0.60
1,2,4-Trimethylcyclopentane	0.13	0.13
3,3-Dimethylhexane	0.06	0.06
2,3,4-Trimethylpentane	0.79	0.82
2,3,3-Trimethylpentane	0.87	0.90
Toluene	6.94	5.97
2,3-Dimethylhexane + C8 olefin	0.41	0.43
C8 Olefin	0.11	0.11
C8 Cyclo-olefin/diolefin	0.06	0.06
2-Methylheptane	0.88	0.94
4-Methylheptane	0.38	0.40
3-Methyl-3-ethylpentane	0.14	0.14
3-Methylheptane	0.96	1.01
3-Ethylhexane + C8 olefin	0.13	0.14

American Petroleum Institute
Certificate #: 31207009
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Date Received: December 7, 1993

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
c-1,4-Dimethylcyclohexane	0.04	0.04
t-1,4-Dimethylcyclohexane	0.03	0.03
2,2,4-Trimethylhexane	0.27	0.28
C8 Naphthene	0.17	0.17
C8 Naphthene	0.12	0.12
Unidentified C8's	0.65	0.68
n-Octane	0.71	0.75
t-1,2-Dimethylcyclohexane	0.14	0.13
1,2,3-Trimethylcyclopentane	0.05	0.05
Isopropylcyclopentane + C8 Cyclo-olefin/Diolefin	0.14	0.13
C9 Paraffin	0.05	0.05
2,5 + 3,5-Dimethylheptane	0.11	0.11
C9 Paraffin	0.18	0.19
C9 Paraffin	0.23	0.24
Ethylbenzene	3.42	2.94
C9 Naphthene	0.04	0.04
m-Xylene	5.37	4.64
p-Xylene	2.18	1.89
3,4-Dimethylheptane	0.05	0.05
2-Methyloctane	0.30	0.31
4-Methyloctane	0.35	0.36
3-Ethylhexane	0.06	0.05
3-Methyloctane	0.36	0.37
3,3-Diethylpentane	0.02	0.02
C9 Naphthene	0.01	0.01
C9 Naphthene	0.03	0.03
o-Xylene	2.64	2.24
C10 Naphthene	0.04	0.04
C9 Naphthene + C9 olefin	0.05	0.05
C10 Naphthene + C9 olefin	0.08	0.07
C9 Naphthene	0.07	0.07
C10 Naphthene + C9 olefin	0.03	0.03
C9 Olefin	0.03	0.03

American Petroleum Institute
Certificate #: 31207009
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CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
Unidentified C9's	0.71	0.72
n-Nonane	0.24	0.25
C9 Olefin	0.03	0.03
C9 Olefin	0.03	0.03
C9 Naphthene	0.02	0.02
C9 Olefin	0.03	0.03
C9 Naphthene	0.02	0.02
C9 Olefin	0.01	0.01
Isopropylbenzene	0.16	0.14
Paraffin	0.05	0.05
Paraffin	0.04	0.04
Paraffin	0.03	0.03
Paraffin	0.07	0.07
n-Propylbenzene	0.77	0.67
1-Methyl-3-ethylbenzene	2.26	1.95
1-Methyl-4-ethylbenzene	1.02	0.88
C10 Paraffin	0.03	0.03
1,3,5-Trimethylbenzene	1.04	0.90
4-Methylnonane	0.05	0.05
2-Methylnonane	0.10	0.10
Paraffin	0.11	0.11
1-Methyl-2-ethylbenzene	0.66	0.56
3-Methylnonane	0.13	0.13
1,2,4-Trimethylbenzene	3.04	2.59
Unidentified C10's	0.19	0.19
n-Decane	0.05	0.05
iso-Butylbenzene	0.14	0.12
1,2,3-Trimethylbenzene	0.62	0.52
Indane	0.40	0.31
C11 Paraffin	0.02	0.02
Indene	0.04	0.03
Naphthene	0.02	0.02
C11 Paraffin	0.04	0.04
1,3-Diethylbenzene	0.22	0.19
1-Methyl-3-n-propylbenzene	0.50	0.43

CERTIFICATE OF ANALYSIS

Component Name	Wt. %	LV %
1-Methyl-4-n-propylbenzene	0.30	0.26
n-Butylbenzene	0.16	0.14
1,2-Diethylbenzene	0.49	0.42
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.05	0.04
1-Methyl-2-n-propylbenzene	0.20	0.17
C11 Paraffin	0.06	0.06
Paraffin	0.08	0.08
1,4-Dimethyl-2-ethylbenzene	0.31	0.26
1,3-Dimethyl-4-ethylbenzene + C10 Indane	0.34	0.29
C10 Indane	0.07	0.06
1,2-Dimethyl-4-ethylbenzene	0.66	0.56
1,3-Dimethyl-2-ethylbenzene + C10 Indane	0.03	0.03
Unidentified C11's	0.23	0.23
Alkylbenzene	0.11	0.09
n-Undecane	0.07	0.07
1,2,4,5-Tetramethylbenzene	0.27	0.23
1,2,3,5-Tetramethylbenzene + C11 Cyclo-diolefin	0.39	0.33
C12 Paraffins	0.15	0.15
C11 Aromatics	1.19	1.04
C10 Indanes	0.67	0.55
Naphthalene	0.63	0.40
Unidentified C12's	0.28	0.26
C11 Indanes	1.10	0.91
C13 Paraffins	0.26	0.25
C12 Aromatics	0.15	0.13
C12 Indanes	0.13	0.11
Methylnaphthalenes	0.93	0.69
Unidentified Heavies	0.37	0.29
Totals	100.00	100.00

American Petroleum Institute
Certificate #: 31207009
Sample ID: API 91-1 Gasoline
Date Received: December 7, 1993

CERTIFICATE OF ANALYSIS

	Wt. %	LV %
Paraffins	43.90	49.41
Naphthenes	4.35	4.28
Aromatics	40.74	34.64
Olefins	9.44	10.18
Unknowns	1.56	1.47
Oxygenates	< 0.01	< 0.01
Totals	100.00	99.99

Paul A. Radenheimer

PAR/ar

API 94-01 [redacted] RESEARCH GASOLINE ANALYSIS

Sample Name: 4025685 API-94-01 CHARGE Customer: M. HENLEY
Acquisition Date: 28-Apr-1994 Acquisition Time: 20:4
Channel #: 6 Analysis: GASO461 Sample #: 2 Injection #:

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

CARBON NO.	PARA	OLEF	NAPH	AROM	UNCLASSIFIED HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCL HEX
3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	****
4	6.19	0.13	******	******	******	6.32	6.07	0.12	******	******	****
5	16.00	3.89	0.23	******	******	20.12	3.73	12.27	******	0.23	****
6	13.32	3.39	1.27	1.59	******	19.56	2.63	10.69	******	1.01	0.
7	8.02	1.58	1.60	8.17	******	19.37	1.21	6.81	******	1.00	0.
8	7.21	0.20	1.07	10.65	0.06	19.19	0.49	2.68	4.04	0.74	0.
9	1.02	0.00	0.46	7.36	0.18	9.01	0.17	0.76	0.09	0.11	0.
10	0.38	0.00	0.04	3.57	0.02	4.01	0.00	0.33	0.05	0.00	0.
11	0.22	0.00	0.00	1.57	0.03	1.81	0.00	0.22	0.00	0.00	0.
12+	0.07	0.00	0.00	0.08	0.45	0.61	0.07	0.00	0.00	0.00	0.
TOT	52.43	9.19	4.66	32.98	0.74	100.00	14.38	33.87	4.18	3.09	1.

2. BY WEIGHT

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	****
4	4.89	0.11	******	******	******	5.00	4.80	0.09	******	******	****
5	13.57	3.49	0.24	******	******	17.30	3.19	10.38	******	0.24	****
6	11.94	3.21	1.30	1.91	******	18.36	2.36	9.58	******	1.03	0.
7	7.48	1.54	1.65	9.64	******	20.32	1.13	6.35	******	1.03	0.
8	6.88	0.20	1.12	12.58	0.06	20.84	0.47	2.56	3.85	0.78	0.
9	0.99	0.00	0.48	8.75	0.18	10.41	0.17	0.74	0.09	0.11	0.
10	0.38	0.00	0.04	4.35	0.02	4.80	0.00	0.33	0.05	0.00	0.
11	0.22	0.00	0.00	2.05	0.03	2.30	0.00	0.22	0.00	0.00	0.
12+	0.08	0.00	0.00	0.10	0.49	0.67	0.08	0.00	0.00	0.00	0.
TOT	46.44	8.55	4.84	39.38	0.78	100.00	12.19	30.26	3.99	3.18	1.

3. BY MOLAR

3-	0.00	0.00	******	******	******	0.00	0.00	******	******	******	****
4	7.74	0.18	******	******	******	7.91	7.59	0.15	******	******	****
5	17.28	4.58	0.31	******	******	22.17	4.06	13.22	******	0.31	****
6	12.73	3.51	1.42	2.24	******	19.91	2.52	10.22	******	1.12	0.
7	6.86	1.45	1.55	9.61	******	19.47	1.03	5.83	******	0.96	0.
8	5.53	0.16	0.92	10.89	0.05	17.55	0.38	2.06	3.10	0.64	0.
9	0.71	0.00	0.35	6.69	0.13	7.89	0.12	0.53	0.06	0.08	0.
10	0.25	0.00	0.03	3.00	0.02	3.29	0.00	0.21	0.03	0.00	0.
11	0.13	0.00	0.00	1.30	0.02	1.44	0.00	0.13	0.00	0.00	0.
12+	0.04	0.00	0.00	0.06	0.27	0.37	0.04	0.00	0.00	0.00	0.
TOT	51.27	9.89	4.58	33.79	0.48	100.00	15.74	32.33	3.19	3.11	1.

GRP. TYPE, VOL %: P = 52.82, O = 9.26, N = 4.70, A = 33.23, Saturates = 57.
DIENE CONTENT = 0. vol ppm AVG MW = 91.9 API GR. = 60.1 SP. GR. =0.73
OCTANE NUMBER: (from pure values) RON = 87.7 MON = 82.3
(from blending values) RON = 90.8 MON = 82.2
CARBON-HYDROGEN RATIO =6.494 STOICH. AIR-FUEL RATIO =14.52 lbs air/lbs fuel
BTU/lb = 11632. NET, 12532. GROSS; BTU/gal = 71694. NET, 77243. GROSS
REID VAPOR PRESSURE = 9.8 BROMINE NO. = 17.2

CHEVRON RESEARCH GASOLINE ANALYSIS
28-Apr-1994 20:43
4025685 API-94-01 CHARGE 6GASO461
Sample 2 Injection 1

* DISTILLATION CURVES

VOL %	TBP	D86
0.	11.	82.
5.	31.	88.
10.	82.	97.
15.	82.	122.
20.	97.	140.
25.	101.	140.
30.	140.	146.
35.	146.	156.
40.	156.	176.
45.	176.	194.
50.	194.	197.
55.	208.	210.
60.	218.	231.
65.	231.	231.
70.	236.	243.
75.	277.	275.
80.	282.	280.
85.	292.	301.
90.	328.	333.
95.	362.	368.
100.	509.	456.

CHEVRON RESEARCH GASOLINE ANALYSIS
28-Apr-1994 20:43
4025685 API-94-01 CHARGE 6GASO461 API 94-01
Sample 2 Injection 1

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
4	7.59	6.07	4.80	N-BUTANE
6	4.06	3.73	3.19	N-PENTANE
9	2.52	2.63	2.36	N-HEXANE
14	1.03	1.21	1.13	N-HEPTANE
23	0.38	0.49	0.47	N-OCTANE
41	0.12	0.17	0.17	N-NONANE
102	0.02	0.04	0.04	N-DODECANE
103	0.02	0.04	0.04	N-TRIDECANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	0.15	0.12	0.09	ISOBUTANE	
7	13.22	12.27	10.38	ISOPENTANE	
12	0.63	0.67	0.59	22-DIME BUTANE	
13	1.56	1.62	1.46	23-DIME BUTANE	
10	5.01	5.28	4.70	2-ME PENTANE	
11	3.01	3.12	2.83	3-ME PENTANE	
18	0.08	0.09	0.08	22-DIME PENTANE	
20	1.02	1.21	1.11	24-DIME PENTANE	
19	1.91	2.20	2.09	23-DIME PENTANE	
15	1.33	1.57	1.45	2-ME HEXANE	
16	1.40	1.63	1.52	3-ME HEXANE	
17	0.09	0.10	0.10	3-ET PENTANE	
37	2.14	2.82	2.66	224-TRIME PENTANE	*
28	0.03	0.04	0.03	22-DIME HEXANE	
36	0.05	0.06	0.06	223-TRIME PENTANE	*
31	0.23	0.31	0.29	25-DIME HEXANE	
30	0.35	0.46	0.44	24-DIME HEXANE	
32	0.03	0.04	0.04	33-DIME HEXANE	
39	0.62	0.78	0.77	234-TRIME PENTANE	*
34	0.06	0.08	0.08	2-ME-3-ET PENTANE	
29	0.29	0.37	0.36	23-DIME HEXANE	*
24	0.59	0.77	0.73	2-ME HEPTANE	
26	0.19	0.25	0.24	4-ME HEPTANE	
25	0.57	0.74	0.71	3-ME HEPTANE	
51	0.06	0.08	0.08	244-TRIME HEXANE	
43	0.06	0.09	0.09	235-TRIME HEXANE	*
53	0.06	0.09	0.08	26-DIME HEPTANE	
55	0.14	0.20	0.19	35-DIME HEPTANE	
56	0.04	0.05	0.05	23-DIME HEPTANE	
57	0.02	0.03	0.03	34-DIME HEPTANE	
62	0.09	0.13	0.13	4-ME OCTANE	
60	0.13	0.19	0.18	2-ME OCTANE	
4650	0.03	0.05	0.05	223-TRIME HEPTANE	*
152	0.03	0.04	0.04	23-DIME OCTANE	
213	0.02	0.03	0.03	C-10 ISOPARAFFINS	
86	0.06	0.10	0.10	4-ME NONANE	

84	0.04	0.07	0.07	2-ME NONANE
85	0.06	0.09	0.09	3-ME NONANE
163	0.09	0.16	0.16	2-ME DECANE
164	0.04	0.06	0.06	3-ME DECANE

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.31	0.23	0.24	CYCLOPENTANE
801	1.12	1.01	1.03	ME CYCLOPENTANE
803	0.04	0.04	0.05	11-DIME CYCPENTANE
806	0.29	0.30	0.31	1C3-DIME CYCPENTANE
807	0.28	0.29	0.30	1T3-DIME CYCPENTANE
805	0.18	0.19	0.19	1T2-DIME CYCPENTANE
811	0.04	0.05	0.05	113-TRIME CPENTANE
802	0.17	0.17	0.18	ET CYCLOPENTANE
817	0.08	0.10	0.10	1T2C4TRIME CPENTANE
814	0.03	0.04	0.04	1T2C3TRIME CPENTANE
810	0.02	0.03	0.03	112-TRIME CPENTANE*
848	0.08	0.11	0.11	11C3T4-TETRME CPENT
864	0.07	0.08	0.08	1MEC3ET CYCPENTANE
865	0.05	0.06	0.06	1MET3ET CYCPENTANE
861	0.29	0.33	0.35	1ME-1ET CYCPENTANE
862	0.05	0.05	0.06	1ME-C2ET CYPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
825	0.30	0.26	0.28	CYCLOHEXANE
826	0.59	0.60	0.63	ME CYCLOHEXANE
831	0.06	0.07	0.08	1C3-DIME CYCHEXANE
830	0.05	0.05	0.06	1T2-DIME CYCHEXANE
832	0.10	0.11	0.12	1T3-DIME CYCHEXANE
829	0.03	0.03	0.03	1C2-DIME CYCHEXANE
827	0.05	0.06	0.06	ETHYL CYCLOHEXANE
946	0.04	0.05	0.05	113-TRIME CYCHEXANE
956	0.04	0.05	0.05	1C3T5-TRIME CYCHEX
941	0.07	0.08	0.09	1ME-C3ET CYCHEXANE
944	0.02	0.03	0.03	1ME-T4ET CYCHEXANE
940	0.02	0.03	0.03	1ME-1-ET CYCHEXANE
949	0.03	0.04	0.05	1C2T3-TRIME CYCHEX
948	0.05	0.06	0.07	1C2C3-TRIME CYCHEX
980	0.03	0.04	0.04	C-10 CYCLOHEXANES

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
304	0.12	0.09	0.07	TRANS-2-BUTENE
303	0.06	0.04	0.04	C1S-2-BUTENE
310	0.07	0.06	0.06	3-METHYL-1-BUTENE
306	0.32	0.28	0.25	1-PENTENE

CHEVRON RESEARCH GASOLINE ANALYSIS
28-Apr-1994 20:43
4025685 API-94-01 CHARGE 6GASO461
Sample 2 Injection 1

309	0.67	0.58	0.51	2-METHYL-1-BUTENE
308	1.08	0.93	0.82	TRANS-2-PENTENE
307	0.58	0.50	0.45	CIS-2-PENTENE
311	1.63	1.38	1.24	2-METHYL-2-BUTENE
450	0.22	0.16	0.17	CYCLOPENTENE
318	0.09	0.09	0.08	3-METHYL-1-PENTENE
323	0.09	0.09	0.08	C-4ME-2-PENTENE
324	0.16	0.16	0.14	T-4ME-2-PENTENE
317	0.27	0.27	0.25	2-ME-1-PENTENE
312	0.15	0.15	0.14	1-HEXENE
315	0.40	0.40	0.37	CIS-3-HEXENE
314	0.48	0.48	0.44	TRANS-2-HEXENE
320	0.44	0.43	0.41	2-METHYL-2-PENTENE
321	0.28	0.27	0.26	C-3ME-2-PENTENE
313	0.24	0.23	0.22	CIS-2-HEXENE
322	0.45	0.43	0.41	T-3ME-2-PENTENE
451	0.47	0.39	0.42	1-ME CYLCOPENTENE
2004	0.03	0.04	0.03	24-DIME-1-PENTENE
2003	0.02	0.03	0.02	23-DIME-1-PENTENE
2009	0.04	0.04	0.04	24-DIME-CIS2-PENTENE
2033	0.07	0.08	0.08	2-ME-T3-HEXENE
2031	0.05	0.06	0.06	5-ME-T2-HEXENE
2010	0.03	0.04	0.04	34-DIME-C2-PENTENE
2038	0.11	0.12	0.12	1-HEPTENE
2035	0.05	0.06	0.06	3-ME-T3-HEXENE
5370	0.11	0.11	0.11	C-7 CYCLOPENTENE A
5371	0.10	0.10	0.10	C-7 CYCLOPENTENE B
2042	0.11	0.12	0.12	T3-HEPTENE
2025	0.14	0.15	0.14	2-ME-2-HEXENE
2034	0.10	0.11	0.11	3-ME-C3-HEXENE
2018	0.08	0.09	0.09	3-ET-2-PENTENE
2040	0.17	0.19	0.18	TRANS-2-HEPTENE
2008	0.12	0.13	0.13	23-DIME-C2-PENTENE
2039	0.11	0.12	0.11	CIS-2-HEPTENE
4528	0.04	0.05	0.05	OCTENE D
4533	0.02	0.03	0.03	OCTENE I
4534	0.03	0.03	0.03	OCTENE J
2193	0.05	0.07	0.06	1-OCTENE
2198	0.02	0.02	0.02	C4-OCTENE

AROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME
600	2.24	1.59	1.91	BENZENE
601	9.61	8.17	9.64	TOLUENE
602	2.34	2.29	2.71	ETHYLBENZENE
604	4.16	4.09	4.81	M-XYLENE
605	1.89	1.87	2.19	P-XYLENE
603	2.49	2.40	2.88	O-XYLENE
607	0.07	0.08	0.09	CUMENE
644	0.45	0.50	0.59	N-PROPYL BENZENE
609	1.44	1.60	1.88	1-ME-3-ET BENZENE
610	0.63	0.70	0.82	1-ME-4-ET BENZENE

CHEVRON RESEARCH GASOLINE ANALYSIS
28-Apr-1994 20:43
4025685 API-94-01 CHARGE 6GASO461
Sample 2 Injection 1

613	0.72	0.80	0.95	135-TRIME BENZENE
608	0.43	0.47	0.56	1-ME-2-ET BENZENE *
612	2.24	2.46	2.93	124-TRIME BENZENE *
615	0.03	0.03	0.04	ISOBUTYLBENZENE
616	0.04	0.05	0.06	SEC BUTYLBENZENE
611	0.49	0.53	0.64	123-TRIME BENZENE *
622	0.03	0.04	0.04	M-CYMENE
650	0.23	0.22	0.29	INDAN *
646	0.12	0.15	0.17	13-DIETHYL BENZENE
647	0.26	0.32	0.38	1-ME-3-PR BENZENE
648	0.23	0.29	0.34	1-ME-4-PR BENZENE
651	0.30	0.36	0.43	12-DIET BENZENE *
653	0.08	0.10	0.12	1-ME-2-PR BENZENE *
654	0.22	0.27	0.32	14-DIME2ET BENZENE *
655	0.15	0.19	0.22	13-DIME4ET BENZENE *
656	0.30	0.37	0.44	12-DIME4ET BENZENE *
659	0.07	0.09	0.11	12-DIME3ET BENZENE
685	0.02	0.02	0.03	2-PHENYL-2ME BUTANE
635	0.16	0.19	0.23	1245-TETME BENZENE *
634	0.26	0.31	0.38	1235-TETME BENZENE *
7800	0.12	0.14	0.18	METHYLINDANE A
660	0.05	0.06	0.07	1-ME35DIET BENZENE
773	0.02	0.02	0.03	C-11 AROMATIC K
7801	0.17	0.18	0.24	METHYLINDANE B
7004	0.07	0.08	0.11	C-11 AROMATIC E
633	0.07	0.08	0.10	1234-TETME BENZENE *
715	0.03	0.03	0.04	TETRALIN *
755	0.05	0.06	0.08	1-ME-3NBU BENZENE
7099	0.02	0.03	0.03	PENTYLBENZENE
768	0.02	0.03	0.03	13-DIME-4PR BENZENE
769	0.02	0.02	0.03	1-ME-35DIET BENZENE
714	0.37	0.39	0.52	NAPHTHALENE *
698	0.06	0.08	0.09	12-DIME-3PR BENZENE
7830	0.03	0.04	0.05	DIMETHYLINDANE A
7831	0.11	0.13	0.17	DIMETHYLINDANE B
771	0.04	0.05	0.06	125-TRIME-3ETBENZENE
693	0.03	0.03	0.04	124-TRIME-5ETBENZENE
694	0.03	0.05	0.05	123-TRIME-5ETBENZENE
7104	0.02	0.03	0.04	135-TRIETHYLBENZENE
772	0.04	0.05	0.06	123-TRIME4ET BENZENE
7835	0.06	0.07	0.09	DIMETHYLINDANE F
7836	0.05	0.06	0.09	DIMETHYLINDANE G
7837	0.05	0.06	0.08	C-11 INDANE H
636	0.02	0.03	0.04	PENTAMETHYLBENZENE
796	0.36	0.40	0.56	2-ME NAPHTHALENE *
795	0.16	0.18	0.25	1-ME NAPHTHALENE *
7910	0.02	0.02	0.03	1-ETHYL NAPHTHALENE
7901	0.02	0.03	0.04	13-DIME NAPHTHALENE

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
188	0.05	0.06	0.06	UNCLASS. H.C. C- 8

CHEVPON RESEARCH GASOLINE ANALYSIS
28-Apr-1994 20:43
4025685 API-94-01 CHARGE 6GASO461
Sample 2 Injection 1

189	0.02	0.03	0.03	UNCLASS. H.C. C- 9
189	0.06	0.08	0.08	UNCLASS. H.C. C- 9
189	0.05	0.06	0.07	UNCLASS. H.C. C- 9
190	0.02	0.02	0.02	UNCLASS. H.C. C-10
191	0.02	0.03	0.03	UNCLASS. H.C. C-11
192	0.02	0.03	0.03	UNCLASS. H.C. C-12
192	0.04	0.07	0.07	UNCLASS. H.C. C-12
192	0.01	0.02	0.02	UNCLASS. H.C. C-12
192	0.02	0.03	0.04	UNCLASS. H.C. C-12
192	0.02	0.04	0.04	UNCLASS. H.C. C-12
192	0.03	0.06	0.06	UNCLASS. H.C. C-12
192	0.01	0.02	0.02	UNCLASS. H.C. C-12
192	0.02	0.04	0.04	UNCLASS. H.C. C-12
192	0.04	0.06	0.06	UNCLASS. H.C. C-12
192	0.01	0.02	0.03	UNCLASS. H.C. C-12
192	0.02	0.04	0.05	UNCLASS. H.C. C-12
192	0.01	0.02	0.02	UNCLASS. H.C. C-12

Clean Air Act Section 211(b)

211(b) Whole Gasoline (Starting Material for Baseline Gasoline vapor Condensate)

DATE OF SHIPMENT

Certificate of Analysis

CUSTOMER ORDER NO.

INV./REQN. NO.

PHILLIPS CHEMICAL COMPANY
A DIVISION OF PHILLIPS PETROLEUM COMPANY

SPECIALTY CHEMICALS
P.O. BOX 968
BORGER, TX 79008-0968

RF-A
9FPATF01

TESTS	RESULTS	SPECIFICATIONS	METHOD
Specific Gravity, 60/60 °F	0.7480	0.7479-0.7503	ASTM D-4052
API Gravity	57.68	57.1 - 57.7	ASTM D-1298
Total Sulfur, ppm	333	339 ± 25	ASTM D-2622
Reid Vapor Pressure	8.75	8.4-8.9	ASTM D-323
Color	Purple	Purple	
Benzene Content	1.38	1.2-1.8	
			ASTM D-86
DISTILLATION, °F			
IBP	97.9		
5%	121.5		
10%	132.8	123-133	
20%	152.9		
30%	174.0		
40%	197.5		
50%	221.4	213-223	
60%	244.4		
70%	269.4		
80%	298.6		
90%	330.0	325-335	
95%	359.2		
EP	406.3		
Loss	0.8		
Residue	1.0		
			ASTM D-1319
HYDROCARBON TYPE, VOL%			
Aromatics	31.2	32 ± 2.7	
Olefins	8.8	9.2 ± 2.5	
Saturates	60.0		
Research Octane Number	92.05	Report	ASTM D-2699
Motor Octane Number	83.15	Report	ASTM D-2700
Antiknock Index	87.6	87.3 +/- 0.5	

EAA:jam
05/05/1999
RD0100

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 9036261 500-362B CHARGE
Customer: ARO, M.L
Acquisition Date: 15-JUN-1999
Acquisition Time: 12:53
Channel #: 113 Analysis: GASO507 Sample #: 2 Injection #: 1

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.02	0.00	******	******	******	0.02	0.02	******	******	******	******
4	3.83	0.18	******	******	******	4.01	3.00	0.83	******	******	******
5	12.63	3.99	0.37	******	******	16.99	4.77	7.86	******	0.37	******
6	10.21	2.67	1.51	1.59	******	15.98	2.77	7.44	******	1.51	0.00
7	9.10	1.48	1.90	7.57	******	20.05	1.66	7.45	******	1.15	0.74
8	7.89	0.44	1.23	11.41	0.16	21.13	0.64	3.15	4.10	0.77	0.47
9	1.65	0.00	1.12	8.91	0.34	12.02	0.25	1.32	0.08	0.10	1.01
10	1.91	0.00	0.06	4.31	0.69	6.96	0.00	1.54	0.37	0.00	0.06
11	0.27	0.00	0.00	1.27	0.54	2.07	0.00	0.27	0.00	0.00	0.00
12+	0.10	0.00	0.00	0.11	0.56	0.77	0.08	0.02	0.00	0.00	0.00
TOT	47.62	8.76	6.18	35.16	2.29	100.00	13.19	29.88	4.55	3.90	2.28

2. BY WEIGHT

3-	0.02	0.00	******	******	******	0.02	0.02	******	******	******	******
4	2.96	0.15	******	******	******	3.10	2.34	0.62	******	******	******
5	10.54	3.53	0.37	******	******	14.43	4.00	6.53	******	0.37	******
6	9.01	2.48	1.52	1.87	******	14.87	2.45	6.56	******	1.52	0.00
7	8.35	1.42	1.93	8.78	******	20.47	1.52	6.83	******	1.16	0.76
8	7.39	0.43	1.27	13.24	0.15	22.48	0.60	2.95	3.83	0.79	0.49
9	1.59	0.00	1.18	10.42	0.34	13.53	0.24	1.28	0.08	0.11	1.08
10	1.87	0.00	0.06	5.12	0.70	7.76	0.00	1.51	0.36	0.00	0.06
11	0.26	0.00	0.00	1.61	0.56	2.43	0.00	0.26	0.00	0.00	0.00
12+	0.10	0.00	0.00	0.14	0.67	0.91	0.08	0.02	0.00	0.00	0.00
TOT	42.08	8.00	6.33	41.17	2.42	100.00	11.24	26.57	4.28	3.94	2.39

3. BY MOLAR

3-	0.03	0.00	******	******	******	0.03	0.03	******	******	******	******
4	4.89	0.25	******	******	******	5.14	3.86	1.03	******	******	******
5	14.05	4.85	0.50	******	******	19.39	5.34	8.71	******	0.50	******
6	10.05	2.85	1.73	2.30	******	16.92	2.73	7.32	******	1.73	0.00
7	8.01	1.39	1.89	9.16	******	20.46	1.46	6.56	******	1.14	0.75
8	6.22	0.36	1.09	11.99	0.13	19.80	0.51	2.49	3.23	0.67	0.42
9	1.19	0.00	0.90	8.34	0.26	10.69	0.18	0.96	0.06	0.08	0.82
10	1.26	0.00	0.04	3.69	0.48	5.48	0.00	1.02	0.25	0.00	0.04
11	0.16	0.00	0.00	1.06	0.35	1.57	0.00	0.16	0.00	0.00	0.00
12+	0.05	0.00	0.00	0.09	0.37	0.51	0.04	0.01	0.00	0.00	0.00
TOT	45.93	9.70	6.16	36.62	1.59	100.00	14.15	28.25	3.53	4.13	2.03

GRP. TYPE, VOL %: P = 48.73, O = 8.96, N = 6.33, A = 35.98, Saturates = 55.06
DIENE CONTENT = 890. vol ppm AVG MW = 96.2 API GR. = 56.7 SP. GR. =0.7517
OCTANE NUMBER: (from pure values) RON = 83.3 MON = 78.2
(from blending values) RON = 86.9 MON = 78.4
CARBON-HYDROGEN RATIO =6.604 STOICH. AIR-FUEL RATIO =14.48 lbs air/lbs fuel
BTU/lb = 11277. NET, 12145. GROSS; BTU/gal = 70741. NET, 76186. GROSS
REID VAPOR PRESSURE = 7.8 BROMINE NO. = 16.4

CHEVRON RESEARCH GASOLINE ANALYSIS
15-JUN-1999 12:53
9036261 500-362B CHARGE 113GAS0507
Sample 2 Injection 1

* DISTILLATION CURVES

VOL %	TBP	D86
0.	-44.	86.
5.	82.	99.
10.	82.	140.
15.	97.	144.
20.	101.	154.
25.	140.	160.
30.	154.	176.
35.	161.	194.
40.	194.	197.
45.	197.	210.
50.	211.	228.
55.	231.	231.
60.	231.	236.
65.	249.	257.
70.	277.	279.
75.	282.	280.
80.	292.	304.
85.	322.	324.
90.	337.	333.
95.	365.	368.
100.	509.	456.

CHEVRON RESEARCH GASOLINE ANALYSIS
15-JUN-1999 12:53
9036261 500-362B CHARGE
Sample 2 Injection 1

113GASO507

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
3	0.03	0.02	0.02	PROPANE
4	3.86	3.00	2.34	N-BUTANE
6	5.34	4.77	4.00	N-PENTANE
9	2.73	2.77	2.45	N-HEXANE
14	1.46	1.66	1.52	N-HEPTANE
23	0.51	0.64	0.60	N-OCTANE
41	0.18	0.25	0.24	N-NONANE
102	0.02	0.04	0.04	N-DODECANE
103	0.02	0.03	0.03	N-TRIDECANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	1.03	0.83	0.62	ISOBUTANE	
8	0.02	0.02	0.02	NEOPENTANE	
7	8.69	7.84	6.52	ISOPENTANE	
12	0.27	0.28	0.24	22-DIME BUTANE	
13	0.93	0.94	0.83	23-DIME BUTANE	
10	3.70	3.79	3.32	2-ME PENTANE	
11	2.42	2.44	2.17	3-ME PENTANE	
18	0.11	0.12	0.11	22-DIME PENTANE	
20	0.90	1.05	0.94	24-DIME PENTANE	
22	0.01	0.01	0.01	223-TRIME BUTANE	
21	0.43	0.48	0.45	33-DIME PENTANE	
19	1.66	1.86	1.73	23-DIME PENTANE	
15	1.54	1.77	1.61	2-ME HEXANE	
16	1.77	2.00	1.84	3-ME HEXANE	
17	0.14	0.16	0.15	3-ET PENTANE	
37	2.32	2.98	2.76	224-TRIME PENTANE	*
28	0.04	0.05	0.04	22-DIME HEXANE	
36	0.05	0.06	0.06	223-TRIME PENTANE	*
31	0.26	0.33	0.31	25-DIME HEXANE	
30	0.38	0.48	0.45	24-DIME HEXANE	
32	0.04	0.05	0.05	33-DIME HEXANE	
39	0.55	0.68	0.65	234-TRIME PENTANE	*
34	0.08	0.10	0.09	2-ME-3-ET PENTANE	
29	0.30	0.38	0.36	23-DIME HEXANE	*
24	0.71	0.91	0.85	2-ME HEPTANE	
26	0.25	0.31	0.29	4-ME HEPTANE	
25	0.73	0.92	0.87	3-ME HEPTANE	
73	0.02	0.02	0.02	224-TRIME HEXANE	
51	0.07	0.10	0.09	244-TRIME HEXANE	
52	0.03	0.04	0.04	24-DIME HEPTANE	
43	0.06	0.08	0.08	235-TRIME HEXANE	*
67	0.01	0.02	0.02	22-DIME HEPTANE	
53	0.09	0.12	0.11	26-DIME HEPTANE	
59	0.01	0.02	0.02	44-DIME HEPTANE	

55	0.20	0.27	0.26	35-DIME HEPTANE
50	0.01	0.02	0.02	234-TRIME HEXANE
56	0.06	0.08	0.08	23-DIME HEPTANE
71	0.03	0.04	0.04	3-ME-4-ET HEXANE
57	0.04	0.05	0.05	34-DIME HEPTANE
66	0.03	0.04	0.04	4-ET HEPTANE
62	0.15	0.21	0.20	4-ME OCTANE
60	0.19	0.27	0.25	2-ME OCTANE
4660	0.02	0.04	0.03	246-TRIME HEPTANE *
76	0.02	0.02	0.02	33-DIET PENTANE
4652	0.02	0.03	0.02	225-TRIME HEPTANE *
4657	0.02	0.03	0.03	236-TRIME HEPTANE *
4659	0.11	0.16	0.16	245-TRIME HEPTANE *
151	0.04	0.06	0.05	22-DIME OCTANE
161	0.02	0.03	0.03	44-DIME OCTANE
4650	0.06	0.09	0.09	223-TRIME HEPTANE *
157	0.02	0.03	0.03	33-DIME OCTANE
5004	0.03	0.05	0.05	2-ME-3-ET HEPTANE
89	0.02	0.02	0.02	4-ET OCTANE
152	0.05	0.07	0.07	23-DIME OCTANE
215	0.02	0.03	0.03	C-11 ISOPARAFFINS
86	0.67	1.01	0.99	4-ME NONANE
84	0.08	0.12	0.12	2-ME NONANE
88	0.01	0.02	0.02	3-ET OCTANE
85	0.08	0.12	0.12	3-ME NONANE
4663	0.02	0.03	0.03	335-TRIME HEPTANE *
163	0.10	0.16	0.16	2-ME DECANE
164	0.05	0.07	0.07	3-ME DECANE
5030	0.01	0.02	0.02	26-DIME UNDECANE

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.50	0.37	0.37	CYCLOPENTANE
801	1.73	1.51	1.52	ME CYCLOPENTANE
803	0.06	0.06	0.06	11-DIME CYCPENTANE
806	0.31	0.31	0.31	1C3-DIME CYCPENTANE
807	0.28	0.29	0.29	1T3-DIME CYCPENTANE
805	0.24	0.24	0.24	1T2-DIME CYCPENTANE
804	0.07	0.07	0.07	1C2-DIME CYCPENTANE
811	0.05	0.06	0.06	113-TRIME CPENTANE
802	0.18	0.18	0.19	ET CYCLOPENTANE
817	0.10	0.11	0.11	1T2C4TRIME CPENTANE
814	0.05	0.06	0.06	1T2C3TRIME CPENTANE
810	0.04	0.05	0.05	112-TRIME CPENTANE*
848	0.05	0.07	0.07	11C3T4-TETRME CPENT
864	0.08	0.09	0.09	1MEC3ET CYCPENTANE
865	0.07	0.08	0.08	1MET3ET CYCPENTANE
861	0.22	0.25	0.26	1ME-1ET CYCPENTANE
812	0.02	0.03	0.03	1C2C3TRIMECPENTANE*
4326	0.01	0.01	0.01	C-9 CYCLOPENTANE B
862	0.03	0.03	0.04	1ME-C2ET CYPENTANE
860	0.02	0.03	0.03	ISOBU CYCLOPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
826	0.75	0.74	0.76	ME CYCLOHEXANE
831	0.08	0.09	0.09	1C3-DIME CYCHEXANE
830	0.06	0.06	0.07	1T2-DIME CYCHEXANE
832	0.12	0.14	0.14	1T3-DIME CYCHEXANE
833	0.06	0.06	0.07	1C4-DIME CYCHEXANE
829	0.04	0.05	0.05	1C2-DIME CYCHEXANE
827	0.06	0.06	0.07	ETHYL CYCLOHEXANE
946	0.05	0.06	0.06	113-TRIME CYCHEXANE
979	0.02	0.03	0.03	C-9 CYLOHEXANES
956	0.05	0.06	0.06	1C3T5-TRIME CYCHEX
950	0.02	0.02	0.02	1T2C3-TRIME CYCHEX
945	0.02	0.03	0.03	112-TRIME CYCHEXANE
941	0.14	0.18	0.19	1ME-C3ET CYCHEXANE
944	0.03	0.04	0.04	1ME-T4ET CYCHEXANE
940	0.17	0.21	0.23	1ME-1-ET CYCHEXANE
949	0.05	0.06	0.06	1C2T3-TRIME CYCHEX
943	0.03	0.03	0.03	1M-C4-ET CYCHEXANE
948	0.18	0.22	0.23	1C2C3-TRIME CYCHEX
836	0.03	0.04	0.04	ISOPR CYCLOHEXANE
835	0.03	0.04	0.04	N-PR CYCLOHEXANE
980	0.04	0.06	0.06	C-10 CYCLOHEXANES

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
302	0.02	0.01	0.01	1-BUTENE
305	0.02	0.01	0.01	ISO-BUTENE
304	0.09	0.07	0.05	TRANS-2-BUTENE
303	0.13	0.09	0.07	C1S-2-BUTENE
310	0.11	0.09	0.08	3-METHYL-1-BUTENE
306	0.41	0.35	0.30	1-PENTENE
309	0.80	0.67	0.58	2-METHYL-1-BUTENE
509	0.03	0.02	0.02	ISOPRENE
308	1.01	0.84	0.73	TRANS-2-PENTENE
327	0.01	0.01	0.01	3,3-DIME BUTENE
307	0.56	0.47	0.41	CIS-2-PENTENE
311	1.63	1.33	1.19	2-METHYL-2-BUTENE
505	0.04	0.03	0.03	T-13-PENTADIENE
530	0.01	0.01	0.01	CYCLOPENTADIENE
504	0.02	0.01	0.01	C-13-PENTADIENE
450	0.24	0.16	0.17	CYCLOPENTENE
318	0.12	0.12	0.11	3-METHYL-1-PENTENE
323	0.09	0.09	0.08	C-4ME-2-PENTENE
324	0.15	0.15	0.13	T-4ME-2-PENTENE
317	0.26	0.25	0.23	2-ME-1-PENTENE
312	0.16	0.15	0.14	1-HEXENE
315	0.36	0.34	0.31	CIS-3-HEXENE
314	0.36	0.35	0.32	TRANS-2-HEXENE
2007	0.04	0.05	0.04	44-DIME-1-PENTENE
320	0.41	0.39	0.36	2-METHYL-2-PENTENE
321	0.25	0.24	0.22	C-3ME-2-PENTENE
313	0.20	0.19	0.18	CIS-2-HEXENE
2005	0.01	0.01	0.01	33-DIME-1-PENTENE

532	0.02	0.01	0.01	2-ME CYCLOPENTADIENE
403	0.01	0.01	0.01	HEPTENES
2011	0.01	0.01	0.01	44-DIME-C2-PENTENE
451	0.45	0.37	0.39	1-ME CYLCOPENTENE
2004	0.03	0.03	0.03	24-DIME-1-PENTENE
2017	0.01	0.01	0.01	3-ET 1-PENTENE
403	0.01	0.01	0.01	HEPTENES
2003	0.02	0.03	0.02	23-DIME-1-PENTENE
2024	0.02	0.02	0.02	5-ME-1-HEXENE
2009	0.03	0.04	0.03	24-DIME-CIS2-PENTENE
403	0.01	0.01	0.01	HEPTENES
403	0.01	0.02	0.01	HEPTENES
2033	0.07	0.08	0.07	2-ME-T3-HEXENE
2031	0.04	0.05	0.04	5-ME-T2-HEXENE
2030	0.03	0.03	0.03	5-ME-C2-HEXENE
2010	0.03	0.03	0.03	34-DIME-C2-PENTENE
2038	0.10	0.11	0.10	1-HEPTENE
2035	0.05	0.05	0.05	3-ME-T3-HEXENE
5370	0.11	0.11	0.11	C-7 CYCLOPENTENE A
5371	0.11	0.10	0.11	C-7 CYCLOPENTENE B
2042	0.10	0.11	0.10	T3-HEPTENE
2025	0.12	0.13	0.12	2-ME-2-HEXENE
2034	0.08	0.09	0.08	3-ME-C3-HEXENE
2018	0.09	0.09	0.09	3-ET-2-PENTENE
2040	0.14	0.15	0.14	TRANS-2-HEPTENE
2008	0.11	0.11	0.11	23-DIME-C2-PENTENE
4526	0.01	0.01	0.01	OCTENE B
4529	0.01	0.02	0.02	OCTENE E
4530	0.01	0.01	0.01	OCTENE F
4532	0.02	0.02	0.02	OCTENE H
4528	0.05	0.07	0.06	OCTENE D
4533	0.03	0.03	0.03	OCTENE I
4534	0.03	0.03	0.03	OCTENE J
404	0.01	0.02	0.02	OCTENES
4531	0.01	0.01	0.01	OCTENE G
2212	0.01	0.01	0.01	6-ME-C2-HEPTENE
2213	0.01	0.01	0.01	6-ME-T2-HEPTENE
2193	0.06	0.07	0.07	1-OCTENE
2198	0.07	0.09	0.08	C4-OCTENE
4536	0.04	0.04	0.04	OCTENE L

AROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME	
600	2.30	1.59	1.87	BENZENE	
601	9.16	7.57	8.78	TOLUENE	
602	2.49	2.38	2.75	ETHYLBENZENE	
604	4.70	4.49	5.19	M-XYLENE	
605	1.97	1.89	2.18	P-XYLENE	
603	2.83	2.65	3.12	O-XYLENE	*
607	0.12	0.13	0.15	CUMENE	
644	0.59	0.64	0.74	N-PROPYL BENZENE	
609	1.70	1.84	2.12	1-ME-3-ET BENZENE	

610	0.77	0.83	0.96	1-ME-4-ET BENZENE	
613	0.85	0.92	1.06	135-TRIME BENZENE	
608	0.54	0.57	0.68	1-ME-2-ET BENZENE	*
612	2.84	3.03	3.55	124-TRIME BENZENE	*
615	0.15	0.18	0.21	ISOBUTYLBENZENE	
616	0.10	0.12	0.14	SEC BUTYLBENZENE	
611	0.64	0.67	0.80	123-TRIME BENZENE	*
622	0.04	0.05	0.06	M-CYMENE	
623	0.03	0.04	0.04	P-CYMENE	
650	0.29	0.27	0.35	INDAN	*
621	0.02	0.03	0.03	O-CYMENE	*
646	0.16	0.20	0.23	13-DIETHYL BENZENE	
647	0.34	0.41	0.47	1-ME-3-PR BENZENE	
648	0.20	0.25	0.29	1-ME-4-PR BENZENE	
614	0.09	0.11	0.13	N-BUTYLBENZENE	
651	0.36	0.43	0.51	12-DIET BENZENE	*
653	0.10	0.12	0.14	1-ME-2-PR BENZENE	*
655	0.26	0.31	0.36	13-DIME4ET BENZENE	*
654	0.18	0.22	0.25	14-DIME2ET BENZENE	*
656	0.36	0.43	0.51	12-DIME4ET BENZENE	*
659	0.09	0.11	0.13	12-DIME3ET BENZENE	
685	0.02	0.03	0.03	2-PHENYL-2ME BUTANE	
683	0.01	0.02	0.02	1-PHENYL-3ME BUTANE	
635	0.18	0.21	0.24	1245-TETME BENZENE	*
634	0.28	0.33	0.39	1235-TETME BENZENE	*
7800	0.12	0.12	0.16	METHYLINDANE A	
660	0.05	0.06	0.07	1-ME35DIET BENZENE	
773	0.02	0.02	0.03	C-11 AROMATIC K	
7801	0.15	0.16	0.21	METHYLINDANE B	
7004	0.07	0.08	0.11	C-11 AROMATIC E	
633	0.07	0.08	0.10	1234-TETME BENZENE	*
715	0.03	0.03	0.04	TETRALIN	*
755	0.05	0.06	0.08	1-ME-3NBU BENZENE	
7099	0.02	0.02	0.03	PENTYLBENZENE	
768	0.02	0.03	0.04	13-DIME-4PR BENZENE	
769	0.02	0.03	0.03	1-ME-35DIET BENZENE	
714	0.36	0.37	0.48	NAPHTHALENE	*
698	0.06	0.07	0.09	12-DIME-3PR BENZENE	
7830	0.03	0.03	0.04	DIMETHYLINDANE A	
7831	0.06	0.06	0.09	DIMETHYLINDANE B	
7833	0.02	0.03	0.03	DIMETHYLINDANE D	
699	0.02	0.02	0.02	135-TRIME-2ETBENZENE	
771	0.04	0.05	0.06	125-TRIME-3ETBENZENE	
693	0.03	0.03	0.04	124-TRIME-5ETBENZENE	
694	0.04	0.06	0.07	123-TRIME-5ETBENZENE	
695	0.01	0.01	0.02	124-TRIME-3ETBENZENE	
7030	0.01	0.01	0.02	C-12 AROMATIC A	
7104	0.01	0.02	0.02	135-TRIETHYLBENZENE	
772	0.03	0.04	0.04	123-TRIME4ET BENZENE	
7101	0.01	0.01	0.01	T-BUTYL-DIMEBENZENES	
7034	0.01	0.01	0.01	C-12 AROMATIC E	
7835	0.04	0.05	0.06	DIMETHYLINDANE F	
7836	0.04	0.05	0.06	DIMETHYLINDANE G	
7837	0.03	0.04	0.05	C-11 INDANE H	

636	0.02	0.03	0.04	PENTAMETHYLBENZENE
796	0.22	0.24	0.33	2-ME NAPHTHALENE *
795	0.10	0.10	0.14	1-ME NAPHTHALENE *
7901	0.02	0.02	0.03	13-DIME NAPHTHALENE

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
188	0.02	0.03	0.03	UNCLASS. H.C. C- 8
188	0.03	0.03	0.03	UNCLASS. H.C. C- 8
188	0.05	0.06	0.06	UNCLASS. H.C. C- 8
188	0.02	0.03	0.03	UNCLASS. H.C. C- 8
189	0.03	0.04	0.04	UNCLASS. H.C. C- 9
189	0.10	0.13	0.13	UNCLASS. H.C. C- 9
189	0.03	0.04	0.04	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.03	0.03	0.03	UNCLASS. H.C. C- 9
189	0.01	0.02	0.02	UNCLASS. H.C. C- 9
189	0.01	0.01	0.01	UNCLASS. H.C. C- 9
189	0.01	0.01	0.01	UNCLASS. H.C. C- 9
190	0.03	0.04	0.04	UNCLASS. H.C. C-10
4052	0.01	0.01	0.01	UNCLASSIFIED C-10 C
4053	0.01	0.02	0.02	UNCLASSIFIED C-10 D
190	0.02	0.02	0.02	UNCLASS. H.C. C-10
190	0.06	0.08	0.08	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
4900	0.02	0.02	0.02	CIS-HYDRINDANE
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.08	0.12	0.12	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.11	0.16	0.16	UNCLASS. H.C. C-10
190	0.02	0.02	0.02	UNCLASS. H.C. C-10
190	0.06	0.08	0.09	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
190	0.01	0.01	0.01	UNCLASS. H.C. C-10
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.03	0.04	0.04	UNCLASS. H.C. C-11
191	0.02	0.03	0.03	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.02	0.03	0.04	UNCLASS. H.C. C-11
191	0.05	0.08	0.08	UNCLASS. H.C. C-11
191	0.01	0.01	0.01	UNCLASS. H.C. C-11
191	0.05	0.07	0.08	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.04	0.06	0.06	UNCLASS. H.C. C-11
191	0.01	0.01	0.01	UNCLASS. H.C. C-11
191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.01	0.01	0.01	UNCLASS. H.C. C-11
191	0.01	0.01	0.02	UNCLASS. H.C. C-11

191	0.01	0.02	0.02	UNCLASS. H.C. C-11
191	0.01	0.01	0.01	UNCLASS. H.C. C-11
192	0.01	0.01	0.01	UNCLASS. H.C. C-12
192	0.01	0.02	0.02	UNCLASS. H.C. C-12
192	0.04	0.07	0.07	UNCLASS. H.C. C-12
192	0.01	0.01	0.02	UNCLASS. H.C. C-12
192	0.01	0.02	0.02	UNCLASS. H.C. C-12
192	0.02	0.03	0.03	UNCLASS. H.C. C-12
192	0.02	0.03	0.03	UNCLASS. H.C. C-12
192	0.01	0.01	0.01	UNCLASS. H.C. C-12
192	0.03	0.04	0.05	UNCLASS. H.C. C-12
193	0.01	0.01	0.02	UNCLASSIFIED C-13
193	0.01	0.02	0.02	UNCLASSIFIED C-13
193	0.02	0.03	0.04	UNCLASSIFIED C-13
193	0.01	0.01	0.02	UNCLASSIFIED C-13
193	0.02	0.02	0.03	UNCLASSIFIED C-13
193	0.01	0.01	0.01	UNCLASSIFIED C-13
193	0.01	0.01	0.01	UNCLASSIFIED C-13

211(6) BASELINE GASOLINE VAPOR CONDENSATE (BATCH A)

CHEVRON RESEARCH GASOLINE ANALYSIS

Sample Name: 500-362P Batch A 11/11/99 \\RALF\EZC
Acquisition Date: 11/11/1999 Acquisition Time: 03:46:06 PM
Channel #: 113 Analysis: data\GASO991111S\991111S_001.dat \\
Method: GasoCaro.met

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.20	0.00	******	******	******	0.20	0.20	******	******	******	******
4	16.46	1.11	******	******	******	17.56	13.05	3.41	******	******	******
5	40.65	10.27	0.55	******	******	51.46	11.08	29.57	******	0.55	******
6	12.58	3.05	1.66	1.32	******	18.61	2.71	9.87	******	1.40	0.26
7	5.18	0.72	0.79	1.90	******	8.59	0.71	4.47	******	0.54	0.26
8	2.26	0.06	0.19	0.76	0.03	3.30	0.07	0.63	1.55	0.14	0.05
9	0.08	0.00	0.02	0.15	0.02	0.27	0.01	0.06	0.00	0.01	0.01
10	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	77.40	15.21	3.22	4.12	0.05	100.00	27.82	48.02	1.55	2.63	0.59

2. BY WEIGHT

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.16	0.00	******	******	******	0.16	0.16	******	******	******	******
4	14.70	1.05	******	******	******	15.75	11.74	2.96	******	******	******
5	39.22	10.48	0.64	******	******	50.35	10.77	28.45	******	0.64	******
6	12.84	3.26	1.94	1.80	******	19.84	2.77	10.07	******	1.62	0.32
7	5.49	0.80	0.93	2.55	******	9.77	0.75	4.74	******	0.63	0.30
8	2.44	0.07	0.23	1.02	0.03	3.79	0.08	0.69	1.67	0.16	0.07
9	0.08	0.00	0.03	0.20	0.03	0.34	0.01	0.07	0.01	0.01	0.02
10	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	74.95	15.67	3.76	5.56	0.06	100.00	26.28	46.99	1.68	3.06	0.71

3. BY MOLAR

C NO.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.27	0.00	******	******	******	0.27	0.27	******	******	******	******
4	18.76	1.39	******	******	******	20.15	14.98	3.77	******	******	******
5	40.31	11.11	0.68	******	******	52.10	11.07	29.24	******	0.68	******
6	11.05	2.88	1.71	1.71	******	17.35	2.39	8.66	******	1.43	0.28
7	4.06	0.61	0.70	2.05	******	7.42	0.55	3.51	******	0.47	0.23
8	1.58	0.05	0.15	0.71	0.02	2.51	0.05	0.45	1.09	0.11	0.04
9	0.05	0.00	0.02	0.12	0.02	0.20	0.00	0.04	0.00	0.01	0.01
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOT	76.09	16.03	3.25	4.59	0.04	100.00	29.32	45.68	1.09	2.69	0.56

GROUP TYPE, VOL %: P = 77.44, O = 15.21, N = 3.22, A = 4.12, Saturates = 80.66
BENZENE CONTENT = 0. vol ppm AVG MW = 74.2 API GR. = 86.5 SP. GR. =0.6491
OCTANE NUMBER: (from pure values) RON = 85.5 MON = 81.3
(from blending values) RON = 89.2 MON = 82.6
CARBON-HYDROGEN RATIO =5.330 STOICH. AIR-FUEL RATIO =15.08 lbs air/lbs fuel
BTU/lb = 18217. NET, 19662. GROSS; BTU/gal = 98673. NET, 106502. GROSS
REID VAPOR PRESSURE =22.4 BROMINE NO. = 34.6

CHEVRON RESEARCH GASOLINE ANALYSIS
11/11/1999 03:46:06 PM
500-362P Batch A 11/11/99 \\RALF\EZC 113data\GAS0991111S\991111S_001.dat \\

DISTILLATION CURVES

VOL %	TBP	D86
0.	-44.	31.
5.	31.	82.
10.	31.	82.
15.	31.	82.
20.	82.	82.
25.	82.	82.
30.	82.	82.
35.	82.	82.
40.	82.	82.
45.	82.	88.
50.	88.	97.
55.	97.	97.
60.	97.	97.
65.	99.	101.
70.	134.	136.
75.	140.	140.
80.	146.	153.
85.	161.	163.
90.	194.	194.
95.	211.	228.
100.	352.	280.

HEVRON RESEARCH GASOLINE ANALYSIS
1/11/1999 03:46:06 PM
00-362P Batch A 11/11/99 \\RALF\EZC 113data\GASO991111S\991111S_001.dat \\

DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

ORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
3	0.27	0.20	0.16	PROPANE
4	14.98	13.05	11.74	N-BUTANE
6	11.07	11.08	10.77	N-PENTANE
9	2.39	2.71	2.77	N-HEXANE
14	0.55	0.71	0.75	N-HEPTANE
23	0.05	0.07	0.08	N-OCTANE

SO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
5	3.77	3.41	2.96	ISOBUTANE
8	0.12	0.13	0.12	NEOPENTANE
7	29.12	29.44	28.33	ISOPENTANE
12	0.43	0.49	0.49	22-DIME BUTANE
13	1.27	1.44	1.48	23-DIME BUTANE
10	4.37	5.01	5.08	2-ME PENTANE
11	2.60	2.93	3.02	3-ME PENTANE
18	0.08	0.10	0.11	22-DIME PENTANE
20	0.74	0.96	1.00	24-DIME PENTANE
21	0.04	0.04	0.05	33-DIME PENTANE
19	0.90	1.13	1.22	23-DIME PENTANE
15	0.79	1.02	1.07	2-ME HEXANE
16	0.88	1.11	1.19	3-ME HEXANE
17	0.07	0.09	0.10	3-ET PENTANE
37	0.89	1.28	1.37	224-TRIME PENTANE *
28	0.01	0.01	0.02	22-DIME HEXANE
36	0.01	0.02	0.02	223-TRIME PENTANE *
31	0.07	0.10	0.10	25-DIME HEXANE
30	0.10	0.14	0.15	24-DIME HEXANE
32	0.01	0.01	0.02	33-DIME HEXANE
39	0.13	0.17	0.19	234-TRIME PENTANE *
34	0.02	0.02	0.02	2-ME-3-ET PENTANE
29	0.06	0.08	0.09	23-DIME HEXANE *
24	0.11	0.15	0.17	2-ME HEPTANE
26	0.04	0.05	0.06	4-ME HEPTANE
25	0.10	0.15	0.16	3-ME HEPTANE
51	0.01	0.01	0.01	244-TRIME HEXANE
55	0.01	0.02	0.02	35-DIME HEPTANE
60	0.01	0.01	0.01	2-ME OCTANE

YCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.68	0.55	0.64	CYCLOPENTANE
801	1.43	1.40	1.62	ME CYCLOPENTANE
803	0.03	0.03	0.04	11-DIME CYCPENTANE

806	0.14	0.16	0.18	1C3-DIME CYCPENTANE
807	0.13	0.15	0.18	1T3-DIME CYCPENTANE
805	0.10	0.12	0.13	1T2-DIME CYCPENTANE
804	0.02	0.02	0.03	1C2-DIME CYCPENTANE
811	0.01	0.02	0.02	113-TRIME CPENTANE
802	0.05	0.05	0.07	ET CYCLOPENTANE
817	0.02	0.03	0.03	1T2C4TRIME CPENTANE
814	0.01	0.01	0.01	1T2C3TRIME CPENTANE
864	0.01	0.01	0.02	1MEC3ET CYCPENTANE
865	0.01	0.01	0.01	1MET3ET CYCPENTANE
861	0.03	0.04	0.05	1ME-1ET CYCPENTANE

YCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
825	0.28	0.26	0.32	CYCLOHEXANE
826	0.23	0.26	0.30	ME CYCLOHEXANE
831	0.01	0.01	0.02	1C3-DIME CYCHEXANE
832	0.01	0.02	0.02	1T3-DIME CYCHEXANE

LEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
302	0.08	0.07	0.06	1-BUTENE
305	0.08	0.07	0.06	ISO-BUTENE
304	0.52	0.42	0.39	TRANS-2-BUTENE
303	0.70	0.55	0.53	C1S-2-BUTENE
310	0.39	0.36	0.37	3-METHYL-1-BUTENE
506	0.01	0.01	0.01	14-PENTADIENE
306	1.04	0.99	0.98	1-PENTENE
309	2.03	1.90	1.92	2-METHYL-1-BUTENE
509	0.07	0.06	0.07	ISOPRENE
308	2.30	2.17	2.18	TRANS-2-PENTENE
327	0.02	0.03	0.03	3,3-DIME BUTENE
307	1.27	1.18	1.20	CIS-2-PENTENE
311	3.44	3.17	3.26	2-METHYL-2-BUTENE
505	0.07	0.06	0.06	T-13-PENTADIENE
530	0.03	0.02	0.03	CYCLOPENTADIENE
504	0.03	0.03	0.03	C-13-PENTADIENE
450	0.42	0.32	0.39	CYCLOPENTENE
318	0.18	0.20	0.21	3-METHYL-1-PENTENE
323	0.13	0.14	0.15	C-4ME-2-PENTENE
324	0.20	0.22	0.23	T-4ME-2-PENTENE
317	0.30	0.33	0.34	2-ME-1-PENTENE
312	0.17	0.18	0.19	1-HEXENE
315	0.36	0.39	0.41	CIS-3-HEXENE
314	0.35	0.38	0.40	TRANS-2-HEXENE
2007	0.04	0.05	0.06	44-DIME-1-PENTENE
320	0.40	0.43	0.45	2-METHYL-2-PENTENE
321	0.24	0.25	0.27	C-3ME-2-PENTENE
313	0.19	0.20	0.22	CIS-2-HEXENE
2005	0.01	0.01	0.01	33-DIME-1-PENTENE

4500	0.01	0.02	0.02	HEPTENE A
403	0.01	0.01	0.01	HEPTENES
451	0.33	0.30	0.36	1-ME CYLCOPENTENE
2004	0.02	0.02	0.03	24-DIME-1-PENTENE
403	0.01	0.01	0.01	HEPTENES
2003	0.01	0.02	0.02	23-DIME-1-PENTENE
2024	0.01	0.01	0.01	5-ME-1-HEXENE
2009	0.02	0.03	0.03	24-DIME-CIS2-PENTENE
403	0.00	0.01	0.01	HEPTENES
403	0.01	0.01	0.01	HEPTENES
2033	0.04	0.05	0.05	2-ME-T3-HEXENE
2031	0.02	0.03	0.03	5-ME-T2-HEXENE
2010	0.01	0.01	0.02	34-DIME-C2-PENTENE
2038	0.04	0.05	0.05	1-HEPTENE
2035	0.02	0.02	0.03	3-ME-T3-HEXENE
5370	0.05	0.05	0.06	C-7 CYCLOPENTENE A
5371	0.04	0.04	0.05	C-7 CYCLOPENTENE B
2042	0.04	0.04	0.05	T3-HEPTENE
2025	0.04	0.05	0.06	2-ME-2-HEXENE
2034	0.03	0.04	0.04	3-ME-C3-HEXENE
2018	0.03	0.04	0.04	3-ET-2-PENTENE
2040	0.05	0.06	0.06	TRANS-2-HEPTENE
2008	0.04	0.04	0.05	23-DIME-C2-PENTENE
4529	0.00	0.01	0.01	OCTENE E
4528	0.01	0.01	0.01	OCTENE D
4533	0.00	0.01	0.01	OCTENE I
4534	0.00	0.01	0.01	OCTENE J
2193	0.01	0.01	0.01	1-OCTENE
2198	0.01	0.01	0.01	C4-OCTENE

ROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME	
600	1.71	1.32	1.80	BENZENE	
601	2.05	1.90	2.55	TOLUENE	
602	0.19	0.20	0.27	ETHYLBENZENE	
604	0.27	0.29	0.39	M-XYLENE	
605	0.12	0.13	0.17	P-XYLENE	
603	0.13	0.14	0.19	O-XYLENE	*
644	0.01	0.01	0.02	N-PROPYL BENZENE	
609	0.03	0.04	0.05	1-ME-3-ET BENZENE	
610	0.01	0.02	0.02	1-ME-4-ET BENZENE	
613	0.01	0.01	0.02	135-TRIME BENZENE	
608	0.01	0.01	0.01	1-ME-2-ET BENZENE	*
612	0.03	0.04	0.05	124-TRIME BENZENE	*

NCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
189	0.01	0.01	0.01	UNCLASS. H.C. C- 9

211(b) BASELINE GASOLINE VAPOR CONDENSATE (BATCH B)

CHEVRON RESEARCH GASOLINE ANALYSIS

ample Name: 500-362P Batch B Drum 1 \\RALF\EZChr
cquisition Date: 11/12/1999 Acquisition Time: 11:03:20 AM
hannel #: 113 Analysis: data\GASO991112S\991112S_002.dat \\
ethod: GasoCaro.met

*** DETAILED COMPOSITION, PERCENT ***

1. BY VOLUME

C O.	PARA	OLEF	NAPH	AROM	UNCL HC	TOTALS BY C #	NORMAL PARA	NON-ALKYL I-PARA	ALKYL I-PARA	CYCLO-PENT	CYCLO-HEX
3-	0.22	0.00	******	******	******	0.22	0.22	******	******	******	******
4	16.53	1.12	******	******	******	17.65	13.14	3.39	******	******	******
5	40.66	10.26	0.54	******	******	51.47	11.03	29.64	******	0.54	******
6	12.51	3.04	1.70	1.32	******	18.57	2.70	9.81	******	1.39	0.30
7	5.10	0.71	0.80	1.91	******	8.53	0.70	4.40	******	0.55	0.26
8	2.25	0.06	0.19	0.78	0.02	3.31	0.07	0.64	1.54	0.14	0.06
9	0.08	0.00	0.02	0.15	0.01	0.25	0.01	0.07	0.00	0.01	0.01
0	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OT	77.35	15.20	3.25	4.15	0.03	100.00	27.86	47.95	1.54	2.63	0.62

2. BY WEIGHT

3-	0.17	0.00	******	******	******	0.17	0.17	******	******	******	******
4	14.77	1.07	******	******	******	15.84	11.82	2.94	******	******	******
5	39.24	10.48	0.63	******	******	50.35	10.72	28.52	******	0.63	******
6	12.77	3.25	1.98	1.80	******	19.80	2.76	10.01	******	1.62	0.37
7	5.41	0.79	0.94	2.56	******	9.70	0.75	4.66	******	0.64	0.31
8	2.44	0.07	0.23	1.05	0.02	3.81	0.08	0.69	1.66	0.16	0.07
9	0.08	0.00	0.02	0.20	0.02	0.32	0.01	0.08	0.00	0.01	0.01
0	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OT	74.89	15.66	3.81	5.61	0.04	100.00	26.31	46.91	1.66	3.06	0.75

3. BY MOLAR

3-	0.28	0.00	******	******	******	0.28	0.28	******	******	******	******
4	18.83	1.41	******	******	******	20.24	15.08	3.75	******	******	******
5	40.31	11.09	0.66	******	******	52.07	11.01	29.30	******	0.66	******
6	10.98	2.87	1.75	1.71	******	17.31	2.37	8.61	******	1.42	0.32
7	4.00	0.60	0.71	2.06	******	7.37	0.55	3.45	******	0.48	0.23
8	1.58	0.05	0.15	0.73	0.01	2.53	0.05	0.45	1.08	0.11	0.04
9	0.05	0.00	0.01	0.12	0.01	0.19	0.01	0.04	0.00	0.01	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OT	76.04	16.02	3.29	4.62	0.02	100.00	29.36	45.60	1.08	2.68	0.60

RP. TYPE, VOL %: P = 77.38, O = 15.21, N = 3.26, A = 4.16, Saturates = 80.63
IENE CONTENT = 0. vol ppm AVG MW = 74.1 API GR. = 86.5 SP. GR. =0.6491
CTANE NUMBER: (from pure values) RON = 85.6 MON = 81.3
(from blending values) RON = 89.2 MON = 82.7
ARBON-HYDROGEN RATIO =5.331 STOICH. AIR-FUEL RATIO =15.08 lbs air/lbs fuel
TU/lb = 18208. NET, 19653. GROSS; BTU/gal = 98625. NET, 106450. GROSS
EID VAPOR PRESSURE =22.5 BROMINE NO. = 34.6

CHEVRON RESEARCH GASOLINE ANALYSIS
11/12/1999 11:03:20 AM
500-362P Batch B Drum 1 \\RALF\EZChr 113data\GAS0991112S\991112S_002.dat \\

* DISTILLATION CURVES

VOL %	TBP	D86
0.	-44.	31.
5.	31.	82.
10.	31.	82.
15.	31.	82.
20.	82.	82.
25.	82.	82.
30.	82.	82.
35.	82.	82.
40.	82.	82.
45.	82.	88.
50.	88.	97.
55.	97.	97.
60.	97.	97.
65.	99.	101.
70.	130.	136.
75.	140.	140.
80.	146.	153.
85.	161.	163.
90.	194.	194.
95.	211.	228.
100.	349.	280.

* DETAILED HYDROCARBON ANALYSIS, EXCLUDING COMPOUNDS BELOW 0.01 VOLUME PERCENT

NORMAL PARAFFINS

CODE	MOL.	VOL.	WT.	NAME
3	0.28	0.22	0.17	PROPANE
4	15.08	13.14	11.82	N-BUTANE
6	11.01	11.03	10.72	N-PENTANE
9	2.37	2.70	2.76	N-HEXANE
14	0.55	0.70	0.75	N-HEPTANE
23	0.05	0.07	0.08	N-OCTANE

ISO-PARAFFINS

CODE	MOL.	VOL.	WT.	NAME	
5	3.75	3.39	2.94	ISOBUTANE	
8	0.13	0.14	0.13	NEOPENTANE	
7	29.17	29.50	28.39	ISOPENTANE	
12	0.42	0.49	0.49	22-DIME BUTANE	
13	1.26	1.43	1.46	23-DIME BUTANE	
10	4.34	4.98	5.05	2-ME PENTANE	
11	2.59	2.92	3.01	3-ME PENTANE	
18	0.08	0.10	0.11	22-DIME PENTANE	
20	0.73	0.95	0.99	24-DIME PENTANE	
19	0.89	1.12	1.21	23-DIME PENTANE	
15	0.79	1.02	1.07	2-ME HEXANE	
16	0.88	1.11	1.18	3-ME HEXANE	
17	0.07	0.09	0.10	3-ET PENTANE	
37	0.89	1.27	1.37	224-TRIME PENTANE	*
28	0.01	0.01	0.02	22-DIME HEXANE	
36	0.01	0.02	0.02	223-TRIME PENTANE	*
31	0.07	0.10	0.10	25-DIME HEXANE	
30	0.10	0.14	0.15	24-DIME HEXANE	
32	0.01	0.01	0.02	33-DIME HEXANE	
39	0.12	0.17	0.19	234-TRIME PENTANE	*
34	0.02	0.02	0.02	2-ME-3-ET PENTANE	
29	0.06	0.08	0.09	23-DIME HEXANE	*
24	0.11	0.15	0.17	2-ME HEPTANE	
26	0.04	0.05	0.06	4-ME HEPTANE	
25	0.10	0.15	0.16	3-ME HEPTANE	
51	0.01	0.01	0.01	244-TRIME HEXANE	
53	0.01	0.01	0.01	26-DIME HEPTANE	
55	0.01	0.02	0.02	35-DIME HEPTANE	
62	0.01	0.01	0.01	4-ME OCTANE	
60	0.01	0.01	0.01	2-ME OCTANE	

CYCLOPENTANES

CODE	MOL.	VOL.	WT.	NAME
800	0.66	0.54	0.63	CYCLOPENTANE
801	1.42	1.39	1.62	ME CYCLOPENTANE

803	0.04	0.04	0.05	11-DIME CYCPENTANE
806	0.14	0.16	0.18	1C3-DIME CYCPENTANE
807	0.13	0.15	0.18	1T3-DIME CYCPENTANE
805	0.10	0.12	0.13	1T2-DIME CYCPENTANE
804	0.02	0.02	0.03	1C2-DIME CYCPENTANE
811	0.01	0.02	0.02	113-TRIME CPENTANE
802	0.05	0.06	0.07	ET CYCLOPENTANE
817	0.02	0.03	0.03	1T2C4TRIME CPENTANE
814	0.01	0.01	0.01	1T2C3TRIME CPENTANE
864	0.01	0.01	0.02	1MEC3ET CYCPENTANE
865	0.01	0.01	0.01	1MET3ET CYCPENTANE
861	0.03	0.04	0.05	1ME-1ET CYCPENTANE

CYCLOHEXANES

CODE	MOL.	VOL.	WT.	NAME
825	0.32	0.30	0.37	CYCLOHEXANE
826	0.23	0.26	0.31	ME CYCLOHEXANE
831	0.01	0.01	0.02	1C3-DIME CYCHEXANE
832	0.01	0.02	0.02	1T3-DIME CYCHEXANE

OLEFINS, DIENES

CODE	MOL.	VOL.	WT.	NAME
302	0.08	0.07	0.06	1-BUTENE
305	0.09	0.07	0.07	ISO-BUTENE
304	0.53	0.42	0.40	TRANS-2-BUTENE
303	0.72	0.56	0.54	C1S-2-BUTENE
310	0.39	0.37	0.37	3-METHYL-1-BUTENE
306	1.04	0.99	0.99	1-PENTENE
309	2.02	1.90	1.92	2-METHYL-1-BUTENE
509	0.08	0.07	0.07	ISOPRENE
308	2.30	2.16	2.18	TRANS-2-PENTENE
327	0.02	0.03	0.03	3,3-DIME BUTENE
307	1.27	1.18	1.20	CIS-2-PENTENE
311	3.44	3.16	3.25	2-METHYL-2-BUTENE
505	0.07	0.06	0.07	T-13-PENTADIENE
530	0.03	0.02	0.03	CYCLOPENTADIENE
504	0.03	0.03	0.03	C-13-PENTADIENE
450	0.42	0.32	0.39	CYCLOPENTENE
318	0.19	0.20	0.21	3-METHYL-1-PENTENE
323	0.13	0.14	0.14	C-4ME-2-PENTENE
324	0.20	0.22	0.23	T-4ME-2-PENTENE
317	0.30	0.32	0.34	2-ME-1-PENTENE
312	0.17	0.18	0.19	1-HEXENE
315	0.36	0.39	0.41	CIS-3-HEXENE
314	0.34	0.37	0.39	TRANS-2-HEXENE
2007	0.05	0.06	0.06	44-DIME-1-PENTENE
320	0.40	0.42	0.45	2-METHYL-2-PENTENE
321	0.24	0.26	0.27	C-3ME-2-PENTENE
313	0.19	0.20	0.21	CIS-2-HEXENE
2005	0.01	0.01	0.01	33-DIME-1-PENTENE

4500	0.01	0.02	0.02	HEPTENE A
403	0.01	0.01	0.01	HEPTENES
451	0.33	0.30	0.36	1-ME CYLCOPENTENE
2004	0.02	0.03	0.03	24-DIME-1-PENTENE
403	0.01	0.01	0.01	HEPTENES
2003	0.01	0.02	0.02	23-DIME-1-PENTENE
2024	0.01	0.01	0.01	5-ME-1-HEXENE
2009	0.02	0.02	0.03	24-DIME-CIS2-PENTENE
403	0.01	0.01	0.01	HEPTENES
2033	0.04	0.05	0.05	2-ME-T3-HEXENE
2031	0.02	0.03	0.03	5-ME-T2-HEXENE
2010	0.01	0.01	0.01	34-DIME-C2-PENTENE
2038	0.04	0.05	0.05	1-HEPTENE
2035	0.02	0.02	0.03	3-ME-T3-HEXENE
5370	0.05	0.05	0.06	C-7 CYCLOPENTENE A
5371	0.04	0.04	0.05	C-7 CYCLOPENTENE B
2042	0.04	0.04	0.05	T3-HEPTENE
2025	0.04	0.05	0.06	2-ME-2-HEXENE
2034	0.03	0.04	0.04	3-ME-C3-HEXENE
2018	0.03	0.04	0.04	3-ET-2-PENTENE
2040	0.05	0.06	0.06	TRANS-2-HEPTENE
2008	0.04	0.04	0.05	23-DIME-C2-PENTENE
4528	0.01	0.01	0.02	OCTENE D
4533	0.00	0.01	0.01	OCTENE I
4534	0.00	0.01	0.01	OCTENE J
4531	0.01	0.01	0.01	OCTENE G
2193	0.01	0.01	0.01	1-OCTENE
2198	0.01	0.01	0.01	C4-OCTENE
4536	0.00	0.01	0.01	OCTENE L

AROMATIC HCS

CODE	MOL.	VOL.	WT.	NAME	
600	1.71	1.32	1.80	BENZENE	
601	2.06	1.91	2.56	TOLUENE	
602	0.19	0.20	0.27	ETHYLBENZENE	
604	0.28	0.30	0.40	M-XYLENE	
605	0.13	0.14	0.18	P-XYLENE	
603	0.14	0.15	0.20	O-XYLENE	*
644	0.01	0.02	0.02	N-PROPYL BENZENE	
609	0.03	0.04	0.05	1-ME-3-ET BENZENE	
610	0.01	0.02	0.02	1-ME-4-ET BENZENE	
613	0.01	0.02	0.02	135-TRIME BENZENE	
608	0.01	0.01	0.01	1-ME-2-ET BENZENE	*
612	0.03	0.04	0.05	124-TRIME BENZENE	*

UNCLASSIFIED HCS

CODE	MOL.	VOL.	WT.	NAME
188	0.01	0.01	0.01	UNCLASS. H.C. C- 8

Other

(not associated with a specific testing program)

CAS # 64741-55-5

CHEMICAL CHARACTERIZATION STUDIES OF LIGHT CATALYTICALLY CRACKED NAPHTHA (LCCN)

STUDY NO.: 41161

MATERIAL TESTED:	Light Catalytically Cracked Naphtha, CRU Number 84152
TEST REQUEST NO.:	41160
PROJECT NO.:	41161
REQUESTOR DIVISION:	US M&R Manufacturing
STUDY PERFORMED BY:	Mobil Environmental and Health Science Laboratory, Pennington Rocky Hill Road, Pennington, New Jersey 08534
DATE OF REPORT:	May 10, 1985

[redacted]

PRINCIPAL INVESTIGATOR

[redacted]

[redacted]

STUDY DIRECTOR

[redacted]

[redacted]

SUPERVISOR

[redacted]

[redacted] 5/28/85

[redacted]

[redacted]

DIRECTOR OF TOXICOLOGY

[redacted]

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SUMMARY

Characterization studies have been carried out on light catalytically cracked naphtha (LCCN) as part of an overall toxicological program to identify potential health effects associated with complex refinery stream materials. Knowledge of the exact chemical composition of the LCCN sample used for toxicological investigations at MEHSL provides a rational and quantitative basis for assessing toxic effect by chemical structure or class. This report describes the analytical methods used to separate, identify and quantitate the large number of volatile hydrocarbon components present in LCCN. The approach involves the use of high resolution capillary gas chromatography for group-type PONA (paraffins, olefins, naphthenes and aromatics) analysis. Identification and quantitation of the individual LCCN components was carried out by gas chromatography, mass spectrometry and comparison of GC retention times with those of reference hydrocarbons. LCCN is the fourth in a series of refinery streams being characterized according to chemical class.

The chemical classes of compounds found for LCCN are summarized in the table below:

Chemical Class Composition of LCCN

Chemical Classes Identified		Weight Percent
P	Paraffins (C4-C11)	
	normal 4.45 wt.%	43.64
	isoparaffins 39.19 wt.%	
O	Olefins (C4-C11)	22.73
N	Naphthenes (C5-C11)	9.69
A	Aromatics (C6-C10)	24.00
	(Benzene 0.056 wt.%)	
		100.06 Total

The PONA classes present in the highest amounts in LCCN are the paraffins (43.64 wt.%) and the aromatics (24.00 wt.%). Of the paraffinics, normal alkanes (C4-C10) comprised 4.45 % of the LCCN weight while the isoparaffinics comprised 39.19 wt.% of LCCN. The major isoparaffins were 2-methylbutane, 2- and 3-methylpentane, 2- and 3-methylhexane, 2- and 3-methylheptane and 2- and 3-methyloctane. Isooctane (2,2,4-trimethylpentane) was present only to the extent of 0.80 wt.%. The major aromatic components identified were the xylenes, toluene, pseudocumene and other trimethyl- or C3-benzenes derivatives. The amount of benzene present in LCCN was very minor, less than 0.06 wt.%. Diaromatics such naphthalene and biphenyl and polycyclic aromatic compounds (greater than 3 rings) were not detected. Olefinics make up 22.73 wt.% of LCCN while the naphthenics make up the remaining 9.69 wt.% of LCCN.

Chemical characterization studies such as the present one are important in risk assessment since they provide key structural clues to the types or classes of compounds in LCCN that may pose potential health risks. LCCN is comprised primarily of volatile paraffins, olefins and cycloalkanes containing five to seven carbon atoms (64 wt.%) and volatile aromatics (six to nine carbons) (24 wt.%). The remainder is mainly C8-C11 hydrocarbons. Since greater than 88% of the components have evaporative characteristics similar to those of n-heptane (b.p. 98°C), the xylenes and trimethylbenzenes (b.p. 120-160°C), LCCN presents some potential health concerns via respiratory exposure. Pulmonary uptake of the volatile LCCN aromatics and isoparaffins will be of toxicological interest. There has been recent interest in the branched paraffins because some members of this chemical class have been shown to induce nephrotoxicity specifically in male rats. The isoparaffins make up 39.2 wt.% of LCCN; however, 2,2,4-trimethylpentane is present only to the extent of 0.8 wt.%. Dermal absorption or bioavailability of the "light end" components of LCCN would not be expected to be significant since they most likely would rapidly evaporate on contact with the skin (assuming no occlusion). Less volatile LCCN component (C8-C11) would be more likely to be absorbed through the skin because of longer contact time. These characterization studies of LCCN not only are useful in identifying the major classes of compounds that may cause toxicity but also in providing volatility information necessary for designing respiratory and dermal experiments in animals.

Because of the volatile components present in LCCN, it was not feasible to use previous fractionation methods to separate them into chemical classes. Instead, an analytical scheme employing thick-film capillary GC columns was used to give complete chromatographic separation of the LCCN components. Identification of PONA components was based on mass spectrometry and comparison with reference hydrocarbons. The methodology developed here for analyzing LCCN should have applicability for characterizing future refinery streams containing principally volatile or naphtha-like hydrocarbons.

INTRODUCTION

In evaluating the health risks associated with refinery stream materials, it is important to establish the exact chemical composition of the test mixture. There are several reasons for carrying out such characterization and quantitation studies. First, refinery streams are very complex mixtures consisting of hundreds of compounds present at varying concentrations. Secondly, since different samples (i.e. fractionation cuts or lot numbers) of refinery streams may differ somewhat, it is extremely important to establish the chemical composition of the actual sample(s) being utilized in biological testing studies. Thirdly, if the chemical structure of the major components is known, this would greatly aid in determining their presence in biological fluids and tissues (e.g. blood, urine, fat). This would be especially relevant in evaluating dermal and respiratory bioavailability of refinery stream constituents. Finally, there is a need to develop a generalized method which would be useful in characterizing and quantitating other future refinery stream mixtures.

Light catalytically cracked naphtha (LCCN) is the fourth in a series of refinery streams undergoing characterization studies in our laboratory. The purpose of this study is: (1) to separate LCCN into distinct chemical classes or PONA (paraffins, olefins, naphthenes and aromatics) group-types, (2) to identify and quantitate the individual components present in each of the chemical classes or fractions, (3) to develop a chemical composition data base so that different refinery streams (e.g. CSO, LCO, HCGO and LCCN) can be compared, (4) to utilize chemical composition data in health risk assessment.

MATERIALS AND METHODS

Chemicals and Test Materials

Light catalytically cracked naphtha (LCCN, CRU Number 84152) was obtained from the Mobil refining and processing unit [redacted]. This petroleum process stream has been termed catalytic cracked naphtha, light (CAS number 64741-55-5) under TSCA's chemical substances inventory. The test material was dispensed in amber bottles and was stored in the freezer at -15 to -20°C. Density of LCCN was determined to be 0.728 gm/ml at room temperature (22°C). Reference hydrocarbon compounds used for identifying LCCN components by GC retention time comparison and for GC-MS analysis were purchased from Aldrich Chemical Co., Milwaukee, WI., Chemicals Procurement Laboratories, College Point, N.Y., and Sigma Chemicals, St. Louis, MI.

Instrumentation

Gas Chromatography

Gas chromatographic-flame ionization detection (GC-FID) analysis were carried out on a Hewlett-Packard 5880A instrument under the following operating conditions:

Carrier gas:	Helium, 0.82 ml/min flow rate at 25 psi column pressure; 27 cm/sec linear velocity.
GC column:	DB-1, 60 meters x 0.25 mm I.D. (1.0 µm film thickness), J&W Scientific Inc., Rancho Cordova, CA.
Injector temp.:	250°C
Detector temp.:	250°C
Initial oven temp.:	35°C
Time at initial temp.:	5 min.
1st Temp. program rate:	2.5°C/min
Level 1 final temp.:	115°C
Time at final temp. 1 :	0.25 min.
2nd Temp. program rate:	5°C/min.
Level 2 final temp.:	200°C
Time at final temp. 2 :	0.25 min.
Split ratio:	50:1
Sample injected:	0.2-0.5 µl

The Hewlett-Packard GC data system was programmed to integrate the individual components by peak area. Data ouput included GC retention time, peak area and area % correponding to each GC peak.

Gas Chromatography-Mass Spectrometry (GC-MS)

Gas chromatographic - mass spectrometric (GC-MS) analysis were performed on a Hewlett Packard 5985 gas chromatograph mass spectrometer interfaced to a HP 7920 data system. Operating conditions were as follows:

Carrier gas:	Helium gas, 42 cm/sec flow rate, 10 psi column pressure
GC column:	Durabond DB-5, 30 meters x 0.25 mm i.d. (0.25 µm film thickness) capillary column, J&W Scientific Inc., Rancho Cordova, CA.
Injector temp.:	250°C
Split inj. mode:	50:1 split ratio
Initial oven temp.:	35°C
Time at initial temp.:	5 min.
Program rate:	2.5°C/min
Final oven temp.:	300°C
Transfer line temp.:	285°C
Ion Source temp.:	200°C
Electron energy:	70 ev (electron impact mode)
Electron multiplier:	2100 ev

Mass spectra were recorded over a scan range of 40-200 amu. Structural elucidation of individual components was based on molecular ion (M+) and comparison of GC retention times with those of available standards (see below).

Structure Assignment

Identification of individual LCCN components was based on comparison of GC retention times with those of standard reference compounds and gas chromatography-mass spectrometry (GC-MS). A thick-film (1.0 µm) GC capillary column (Durabond DB-1, 60 meters) was used in order to resolve each LCCN component. A majority of the LCCN components was identified by chromatographic comparison with commercially available reference hydrocarbons and/or by GC-MS (molecular ion or fragment ion). Some components were identified by relative retention times based on reported literature elution profiles of naphtha samples similar in composition to that found in LCCN (see reference 1). There were many minor components whose exact structure could not be unequivocally assigned because of lack of reference standards or because it was one of many isomers theoretically possible. Based on relative GC retention times, unidentified LCCN components could be classified according to carbon numbers. For example, an unidentified LCCN component falling in the GC chromatogram between n-heptane and n-octane was classified as a C7 hydrocarbon. The major normal alkanes and isoparaffins were identified by GC retention time comparison and/or by GC-MS (m/z M+ and 57, 71). Cycloalkanes and olefins were

identified by GC retention times or by GC/MS (m/z M+). Aromatic hydrocarbons were identified by mass spectral analysis; M+ molecular ion at 92, 106, 120, 134 and characteristic fragment ions at m/z 91, 105, 119. Reference alkylbenzene compounds were available for chromatographic comparison.

Quantitation

Since LCCN was analyzed neat by capillary GC, the total area of all the GC peaks represent the entire weight and chemical composition of the injected LCCN sample. Because flame ionization detection generally gives equal response to the equal weights of different hydrocarbons, the relative peak areas can be directly used to calculate or give weight percent values (1-4). Test mixtures of known weight percentages of standard alkanes, isoalkanes, naphthenes (cycloalkanes) and aromatics were prepared and analyzed by GC-FID to validate that the GC peak area percent is a good reflection and measure of the weight percent in the mixture. In this manner, the peak area % generated by the Hewlett-Packard data system can be used directly as the weight percent of the components present in the standard test mixture of LCCN mixture. LCCN components were quantitated by taking the areas % values generated from the Hewlett-Packard data system. A computer program was written in FORTRAN to assist in calculating the total wt.% of the LCCN components. A complete discussion is given in the appendix. The average weight % values found for the LCCN components represent the mean of four determinations.

PONA Chemical Class Quantitation

For each PONA class, the identified individual LCCN components were classified as paraffinic [normal and branched (isoparaffin)], olefinic, naphthenic or aromatic. Components falling under each PONA classification were grouped and the total weight % tabulated for the four PONA groups.

RESULTS AND DISCUSSION

Thick-Film Capillary GC Columns

Petroleum or naphtha samples represent complex mixtures that may contain hundreds of components. In order to separate the individual LCCN components, a bonded-phase DB-1 capillary GC column having a film thickness of 1.0 μm and a length of 60 meters was used. Capillary GC columns of this type have been manufactured for the purpose of analyzing volatile hydrocarbons like those present in naphthas and gasolines (5). Preliminary GC studies were carried out to optimize chromatographic resolution. The temperature program listed in the experimental section was the one that gave the best resolution of LCCN components. The use of long and thick-film capillary GC columns to analyze gasoline and naphtha mixtures is becoming increasingly more common (1,6,7). For example, Ettre and coworkers (1) have applied similar analytical GC-FID schemes in identifying and grouping about 270 components in PONA (paraffins, olefins, naphthenes and aromatics) classes for a number of gasoline samples. Bloch et al have also reported using high resolution capillary GC for the PONA composition of gasoline and naphtha. As mentioned by Ettre et al in their paper (1), there is an ASTM study group investigating the possibility of using high resolution GC as a standard approach to analyzing and classifying gasoline and naphtha mixtures according to PONA group-types.

Chromatographic Separation and PONA Classification of LCCN

Using the capillary GC technique described above, LCCN was separated into 227 peaks or components. Figure 1 shows the chromatogram of a typical GC run of LCCN. The peaks are numbered consecutively in order of their retention times. The major GC peaks are labelled in Figure 1. Of the 227 peaks, 93 were identified based on comparison of GC retention times with standards or by GC-MS evidence. Although there were 134 peaks that have not been unequivocally identified, almost all of the individual peaks represent only minor components (0.01 to 0.40 wt.%; only seven unknown are greater than 0.4 wt.%). Nevertheless, we were able to assign the minor unknown components according to carbon number based on their relative GC retention times in comparison to standard n-alkanes (C5 to C12). A complete listing of the LCCN components is given in Table 1. Peak numbers, retention times, peak area % or weight %, PONA classification and the number of carbon atoms in the compound are given in Table 1 also. Paraffins fell into the sub-categories, normal alkanes or isoparaffins.

PONA Chemical Classes

Paraffins, Normal and Branched

Based on structural assignment, the LCCN components can be broken down and grouped according to chemical class. Classification of LCCN according to PONA groups is summarized in Table 2. The total paraffinics represent 43.64 wt.% of LCCN with the normal paraffins (C4-C10) comprising 4.45 wt.% and the isoparaffins (C4-C11) comprising 39.2 wt.%. A complete listing of the identified paraffins are summarized in Table 3. Of the normal alkanes, n-pentane and n-hexane were present in highest concentrations. The major isoparaffins found in LCCN included 2-methylbutane (6.97 wt.%), 2-methylpentane (4.11 wt.%), 3-methylpentane (2.47 wt.%), 2-methylhexane (2.17 wt.%), 3-methylhexane (2.05 wt.%), 2-methylheptane (1.22 wt.%), 3-methylheptane (1.45 wt.%) and 2-methyloctane (1.03 wt.%). Isooctane or 2,2,4-trimethylpentane was found to be present at 0.80 wt.% in LCCN; 2,3,4-trimethylpentane was also found to the extent of 0.48 wt.%.

Olefins

The olefins comprised 22.73 wt.% of LCCN. The major olefins identified were less than six to seven carbons (see Table 4) and included: trans- and cis-2-butene, 1-pentene, 2-methyl-1-butene, trans- and cis-2-pentene, 2-methyl-2-butene, 1-hexene, trans-2-hexene, 2-methyl- and 3-methyl-2-pentene, 3,3-dimethyl-1-pentene and 1-heptene.

Naphthenes

The naphthenics or cycloalkanes were found to comprise 9.69 wt.% of LCCN. As shown in Table 5, the major cycloalkanes identified were methylcyclopentane, ethylcyclopentane, methylcyclohexane, the dimethylcyclohexane isomers and trimethylcyclopentane isomers. The cycloolefins were included with the naphthenics and represented only a minor percent of the total LCCN weight.

Aromatics

Aromatic components were found to comprise about 24.0 wt.% in LCCN. Table 6 lists the major aromatic components identified in LCCN. Structure assignment was based on GC-MS and on GC retention time comparison with reference aromatic compounds. Toluene, the xylene isomers and ethylbenzene represent 13.74 wt.% of LCCN. Benzene, on the other hand was present in very small amounts (0.056 wt.%). The C9 alkylbenzenes make up 8.65 wt.% of LCCN with the major components being 1,2,4-trimethylbenzene (pseudocumene) (2.9 wt.%), 1-methyl-3-ethylbenzene (1.92 wt.%) and 1,3,5-trimethylbenzene (mesitylene) (1.00 wt.%); other C9 aromatics are listed in Table 6). The C10 aromatics accounted for a mere 1.45 wt.% and included n-butylbenzene, two diethylbenzene isomers, three tetramethylbenzene derivatives (durene, isodurene and prehnitene)

and p-cymene. Although indane and indene were detected in LCCN, there is no indication that decalin (1,2,3,4-tetrahydronaphthalene), naphthalene or biphenyl derivatives were present in LCCN. Polycyclic aromatic compounds (3-ring or larger) were not detected in LCCN. Mass spectral analysis did not reveal the presence of phenolic or other heterocyclic compounds (e.g. carbazoles).

PONA Group Composition of Various LCCNs

Analysis of the LCCN sample (CRU No. 84152) which has been used for toxicolgical testing at MEHSL was carried out by capillary GC methods described in this report. The chemical class composition (PONA group-types) of LCCN is given in Table 2. Because light catalytically cracked naphtha samples can vary in composition depending on the refinery process or cuts, it was important for us to determine the PONA breakdown of the actual sample being utilized for toxicity evaluation in animals. MacFarland et al (8) has reported the PONA range for a number of generic light catalytical cracked naphthas (data from 11 companies) which supposedly have the same TSCA classification as our LCCN sample. Comparison of the PONA composition of LCCN from this study with that reported for generic LCCNs (8) and with that reported for API PS-6 unleaded gasoline (9) is summarized below:

Comparison of PONA Group Composition of LCCN (CRU No. 84152), generic LCCNs and API PS-6 Unleaded Gasoline

PONA Group	LCCNs MacFarland (8)	LCCN This Study	API PS-6 Unleaded Gasoline (9)
Paraffins, %	21-44	43.64	57.9
Olefins, %	15-69	22.73	9.0
Naphthenes, %	10-16	9.69	4.7
Aromatics, %	6-28	24.00	28.4

The PONA data cited by MacFarland et al is a compilation of chemical composition information submitted by eleven companies (8). In light of the expected variation amongst different samples of cracked naphthas, (especially from different chemical or oil companies), the PONA chemical composition generated in this report for LCCN (CRU No. 84152) falls within the range reported by MacFarland. Since it is known that light catalytically cracked naphthas contain a relatively high proportion of olefins (15-69 %) (8), the PONA analysis generated for the CRU No. 84152 sample indicates that the LCCN in our hands is of the "low-olefin" classification.

Volatility of LCCN Components

Breakdown of the LCCN paraffins, olefins and naphthenes according to the total number of carbons is summarized in Table 7. The aromatics (C6-C10) are also listed in the table. From this type of analysis, it is evident that LCCN is comprised primarily of volatile paraffins, olefins and cycloalkanes containing five to seven carbons (64 wt.%) and of volatile aromatics (six to ten carbons) (24.0 wt.%). The remainder is mainly comprised of C8-C11 hydrocarbons. Since about 88 wt.% of the components have evaporative characteristics similar to those of n-heptane (b.p. 98°C) and the xylenes and the trimethylbenzenes (b.p. 120-160°C), LCCN presents some potential health concern via respiratory exposure. Pulmonary uptake of the volatile LCCN aromatics and isoparaffins will be of toxicological interest. There has been recent interest in the branched isoparaffins because some members of this chemical class have been shown to induce nephrotoxicity specifically in male rats (9). The isoparaffins make up 39.2 wt.% of LCCN; however, 2,2,4-trimethylpentane is present only to the extent of 0.8 wt.%. Dermal absorption or bioavailability of the "light-end" components of LCCN would not be expected to be significant since they would most likely evaporate on contact with the skin (assuming no occlusion). Less volatile LCCN components (C8-C11) would be more likely to be absorbed through the skin because of longer contact times due to slower evaporation. These characterization studies of LCCN not only are useful in identifying the major classes of compounds that may cause toxicity but also in providing volatility information necessary for designing respiratory and dermal experiments in animals.

In summary, LCCN was separated into PONA chemical classes using an analytical scheme that employs thick-film capillary GC columns. Because of the volatile components present in LCCN, fractionation methods previously used to separate refinery streams into different chemical classes could not be utilized. However, the use of 60 meter, thick-film capillary GC gave good resolution of LCCN components. Identification of PONA components in LCCN was based on mass spectrometry and comparison of GC retention times with those of reference compounds. The methodology developed here for analyzing LCCN will have applicability in characterizing future refinery streams containing relatively volatile or naphtha-like hydrocarbons. The structural and quantitative information provided by characterization studies of this type is important in identifying chemical components or classes in LCCN that may be of health concern. Moreover, the chemical compositional data attained for LCCN provides a basis whereby different refinery streams can be compared by chemical class.

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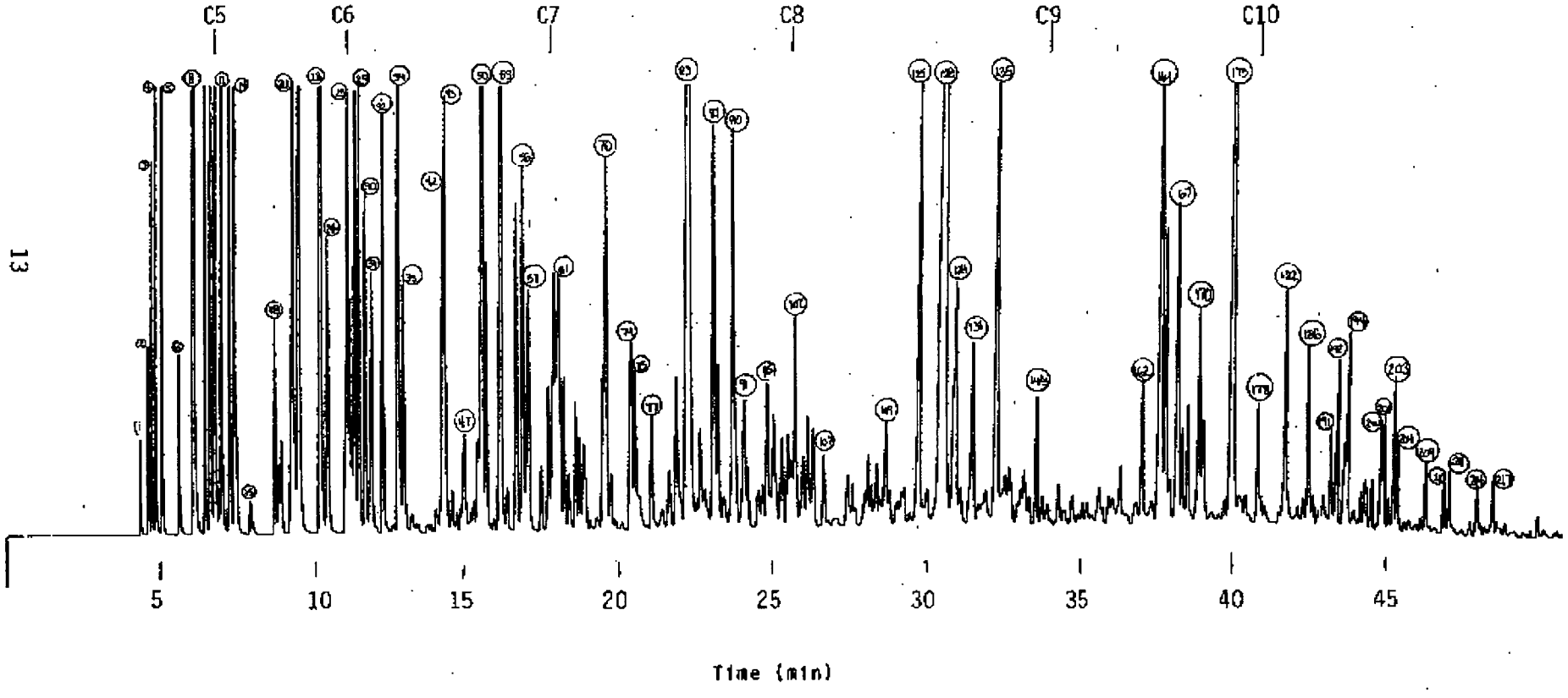

Figure 1. Capillary GC tracing of LCCN components. Column and conditions as described in the materials and methods section. The numbers identifying the individual peaks correspond to the peak numbers in Table 1. The carbon numbers given at the top indicate where the corresponding n-alkane hydrocarbons appear in the GC.

Table 1

Full Analytical Report of LCCN Components Corresponding to the Gas Chromatogram in Figure 1

Peak No.	Retention Time (min)	Weight Percent	No. of Carbons	Compound
001	4.41	0.088	4	UNKNOWN
002	4.66	0.226	4	N-BUTANE
003	4.78	0.373	4	1-BUTENE
004	4.90	0.630	4	TRANS-2-BUTENE *
005	5.11	0.691	4	CIS-2-BUTENE *
006	5.70	0.226	5	3-METHYL-1-BUTENE
007	5.99	0.054	5	UNKNOWN
008	6.11	6.969	5	2-METHYLBUTANE
009	6.47	0.761	5	1-PENTENE
010	6.65	1.261	5	2-METHYL-1-BUTENE
011	6.80	1.367	5	N-PENTANE
012	6.94	0.061	5	ISOPRENE
013	7.02	1.924	5	TRANS-2-PENTENE
014	7.28	1.073	5	CIS-2-PENTENE
015	7.45	2.577	5	2-METHYL-2-BUTENE
016	7.96	0.049	5	UNKNOWN
017	8.05	0.027	6	2,2-DIMETHYLBUTANE
018	8.78	0.366	6	3-METHYL-1-PENTENE
019	8.90	0.120	5	CYCLOPENTENE
020	8.98	0.182	6	2,3-DIMETHYL-1-BUTENE
021	9.35	1.331	6	2,3-DIMETHYLBUTANE
022	9.55	4.110	6	2-METHYLPENTANE
023	10.26	2.474	6	3-METHYLPENTANE
024	10.48	0.851	6	1-HEXENE
025	11.16	1.051	6	N-HEXANE
026	11.24	0.434	6	TRANS-3-HEXENE
027	11.32	0.161	6	UNKNOWN
028	11.41	0.875	6	TRANS-2-HEXENE
029	11.55	0.894	6	2-METHYL-2-PENTENE
030	11.74	0.772	6	3-METHYL-2-PENTENE
031	11.96	0.609	6	4-METHYLCYCLOPENTENE
032	12.34	0.886	7	3,3-DIMETHYL-1-PENTENE
033	12.65	0.026	7	2,2-DIMETHYLPENTANE
034	12.85	2.259	6	METHYLCYCLOPENTANE
035	13.01	0.619	7	2,4-DIMETHYLPENTANE
036	13.27	0.058	7	UNKNOWN
037	13.38	0.022	7	UNKNOWN
038	13.48	0.020	7	UNKNOWN
039	13.75	0.024	7	UNKNOWN
040	13.88	0.022	7	UNKNOWN
041	14.06	0.073	7	UNKNOWN
042	14.27	0.867	7	UNKNOWN
043	14.36	0.936	7	UNKNOWN
044	14.59	0.105	7	UNKNOWN
045	14.74	0.052	7	UNKNOWN
046	14.90	0.056	6	BENZENE
047	15.00	0.307	6	CYCLOHEXENE
048	15.27	0.133	7	UNKNOWN
049	15.48	0.219	7	UNKNOWN
050	15.59	2.176	7	2-METHYLHEXANE
051	15.73	0.599	7	2,3-DIMETHYLPENTANE
052	15.95	0.029	7	1,1-DIMETHYLCYCLOPENTANE
053	16.22	2.049	7	3-METHYLHEXANE
054	16.42	0.102	7	UNKNOWN
055	16.73	0.777	7	UNKNOWN
056	16.93	1.016	7	1-HEPTENE
057	17.13	0.803	8	2,2,4-TRIMETHYLPENTANE
058	17.54	0.154	7	UNKNOWN
059	17.78	0.362	7	UNKNOWN
060	17.98	0.880	7	N-HEPTANE
061	18.11	1.130	7	UNKNOWN
062	18.30	0.340	7	UNKNOWN
063	18.45	0.163	7	UNKNOWN
064	18.67	0.294	7	UNKNOWN
065	18.81	0.217	8	2,4,4-TRIMETHYLPENTENE
066	18.93	0.308	7	UNKNOWN
067	19.16	0.028	7	UNKNOWN
068	19.37	0.056	7	UNKNOWN
069	19.58	0.447	7	UNKNOWN
070	19.68	0.953	7	METHYLCYCLOHEXANE
071	19.84	0.148	8	2,2-DIMETHYLHEXANE
072	20.01	0.032	7	UNKNOWN
073	20.20	0.026	7	UNKNOWN
074	20.51	0.692	7	ETHYLCYCLOPENTANE
075	20.64	0.452	8	2,5-DIMETHYLHEXANE

Table 1 (Continued)

Full Analytical Report of LCCN Components
Corresponding to the Gas Chromatogram in Figure 1

Peak No.	Retention Time (min)	Weight Percent	No. of Carbons	Compound
076	20.78	0.104	6	2,4-DIMETHYLHEXANE
077	21.17	0.291	6	1,2,4-TRIMETHYLCYCLOPENTANE
078	21.29	0.013	6	UNKNOWN
079	21.52	0.091	8	3,3-DIMETHYLHEXANE
080	21.75	0.215	8	1,2,3-TRIMETHYLCYCLOPENTANE
081	21.98	0.475	8	2,3,4-TRIMETHYLPENTANE
082	22.11	0.114	8	UNKNOWN
083	22.42	4.685	7	TOLUENE
084	22.65	0.080	8	UNKNOWN
085	22.77	0.278	8	2,3-DIMETHYLHEXANE
086	22.90	0.196	8	UNKNOWN
087	23.22	1.219	8	2-METHYLHEPTANE
088	23.33	0.400	8	4-METHYLHEPTANE
089	23.53	0.140	8	3,4-DIMETHYLHEXANE
090	23.85	1.448	8	3-METHYLHEPTANE
091	24.20	0.482	8	CIS-1,3-DIMETHYLCYCLOHEXANE
092	24.33	0.144	8	TRANS-1,4-DIMETHYLCYCLOHEXANE
093	24.65	0.117	9	2,2,5-TRIMETHYLHEXANE
094	24.82	0.106	8	UNKNOWN
095	24.98	0.326	8	1-OCTENE
096	25.05	0.006	8	UNKNOWN
097	25.17	0.259	8	UNKNOWN
098	25.27	0.098	8	UNKNOWN
099	25.46	0.250	7	CYCLOHEPTANE
100	25.66	0.242	8	UNKNOWN
101	25.76	0.242	8	UNKNOWN
102	25.92	0.541	8	N-OCTANE + TRANS-1,2-DIMETHYLCYCLOHEXANE
103	26.07	0.056	8	UNKNOWN
104	26.17	0.194	8	UNKNOWN
105	26.33	0.320	8	UNKNOWN
106	26.51	0.334	8	UNKNOWN
107	26.86	0.202	8	UNKNOWN
108	27.02	0.019	8	UNKNOWN
109	27.20	0.028	8	UNKNOWN
110	27.29	0.035	8	UNKNOWN
111	27.66	0.197	8	UNKNOWN
112	27.85	0.118	8	UNKNOWN
113	27.94	0.044	8	UNKNOWN
114	28.24	0.115	9	UNKNOWN
115	28.35	0.191	8	UNKNOWN
116	28.47	0.113	8	UNKNOWN
117	28.62	0.188	8	UNKNOWN
118	28.74	0.107	8	ETHYLCYCLOHEXANE
119	28.91	0.320	9	2,6-DIMETHYLHEPTANE
120	29.04	0.126	8	UNKNOWN
121	29.32	0.112	8	UNKNOWN
122	29.44	0.095	8	UNKNOWN
123	29.54	0.134	8	UNKNOWN
124	29.72	0.044	8	UNKNOWN
125	30.03	1.501	8	ETHYLBENZENE
126	30.17	0.029	8	UNKNOWN
127	30.29	0.140	9	UNKNOWN
128	30.82	5.620	8	P&M-XYLENES
129	31.23	1.013	9	2-METHYLOCTANE
130	31.39	0.157	9	3-ETHYLHEPTANE
131	31.81	0.703	9	3-METHYLOCTANE
132	31.99	0.081	9	UNKNOWN
133	32.17	0.052	9	UNKNOWN
134	32.24	0.183	9	UNKNOWN
135	32.61	2.033	8	O-XYLENE
136	32.77	0.034	9	UNKNOWN
137	32.88	0.253	9	UNKNOWN
138	33.00	0.160	9	UNKNOWN
139	33.09	0.124	9	UNKNOWN
140	33.29	0.059	9	UNKNOWN
141	33.38	0.123	9	UNKNOWN
142	33.51	0.219	9	UNKNOWN
143	33.67	0.098	9	UNKNOWN
144	33.91	0.342	9	N-NONANE
145	34.10	0.087	9	UNKNOWN
146	34.24	0.078	9	UNKNOWN
147	34.61	0.143	9	UNKNOWN
148	34.78	0.052	9	UNKNOWN
149	34.83	0.031	9	UNKNOWN
150	35.06	0.118	9	ISOPROPYLBENZENE(CUMENE)

Table 1 (Continued)

Full Analytical Report of LCCN Components Corresponding to the Gas Chromatogram in Figure 1

Peak No.	Retention Time (min)	Weight Percent	No. of Carbons	Compound
151	35.26	0.043	9	UNKNOWN
152	35.42	0.070	9	UNKNOWN
153	35.58	0.095	8	CYCLOOCTANE
154	35.73	0.049	9	UNKNOWN
155	35.96	0.150	9	UNKNOWN
156	36.06	0.060	9	UNKNOWN
157	36.28	0.096	9	UNKNOWN
158	36.40	0.132	9	UNKNOWN
159	36.59	0.049	9	UNKNOWN
160	36.68	0.190	9	UNKNOWN
161	37.18	0.121	9	UNKNOWN
162	37.39	0.474	9	N-PROPYLBENZENE
163	37.72	0.165	9	UNKNOWN
164	38.01	1.924	9	1-METHYL-3-ETHYLBENZENE
165	38.15	0.793	9	1-METHYL-4-ETHYLBENZENE
166	38.28	0.182	9	UNKNOWN
167	38.54	1.008	9	1,3,5-TRIMETHYLBENZENE(MESITYLENE)
168	38.72	0.278	9	UNKNOWN
169	38.90	0.385	9	UNKNOWN
170	39.27	0.656	9	1-METHYL-2-ETHYLBENZENE(2-ETHYLTOLUENE)
171	39.39	0.357	9	UNKNOWN
172	39.70	0.091	9	UNKNOWN
173	39.91	0.059	9	UNKNOWN
174	40.12	0.093	9	UNKNOWN
175	40.38	2.900	9	1,2,4-TRIMETHYLBENZENE (PSEUDOCUMENE)
176	40.58	0.139	9	UNKNOWN
177	40.62	0.021	9	UNKNOWN
178	40.78	0.112	9	UNKNOWN
179	41.20	0.314	10	N-DECANE
180	41.29	0.084	10	ISOBUTYLBENZENE
181	41.44	0.094	10	UNKNOWN
182	41.90	0.043	10	UNKNOWN
183	42.10	0.774	9	1,2,3-TRIMETHYLBENZENE(HEMIMELITENE)
184	42.33	0.026	10	P-CYMENE
185	42.49	0.080	10	UNKNOWN
186	42.67	0.073	10	UNKNOWN
187	42.85	0.454	10	UNKNOWN
188	42.96	0.117	9	INDENE
189	43.19	0.051	10	UNKNOWN
190	43.35	0.120	9	INDAN
191	43.44	0.033	10	UNKNOWN
192	43.60	0.253	10	UNKNOWN
193	43.76	0.435	10	UNKNOWN
194	43.99	0.219	10	1,4-DIETHYLBENZENE
195	44.10	0.558	10	N-BUTYLBENZENE
196	44.32	0.097	10	1,2-DIETHYLBENZENE
197	44.55	0.102	10	UNKNOWN
198	44.67	0.194	10	UNKNOWN
199	44.90	0.140	12	DICYCLOHEXYL
200	45.06	0.024	10	UNKNOWN
201	45.18	0.262	10	UNKNOWN
202	45.28	0.310	10	UNKNOWN
203	45.44	0.096	10	UNKNOWN
204	45.60	0.342	10	UNKNOWN
205	45.73	0.231	10	UNKNOWN
206	45.96	0.035	10	UNKNOWN
207	46.12	0.057	11	UNKNOWN
208	46.34	0.044	11	UNKNOWN
209	46.48	0.044	11	UNKNOWN
210	46.66	0.187	11	UNKNOWN
211	47.25	0.124	10	1,2,4,5-TETRAMETHYLBENZENE (DURENE)
212	47.43	0.184	10	1,2,3,5-TETRAMETHYLBENZENE(ISODURENE)
213	47.82	0.024	11	UNKNOWN
214	48.10	0.041	11	UNKNOWN
215	48.33	0.132	11	UNKNOWN
216	48.42	0.026	10	CIS-CYCLODECENE
217	48.57	0.017	11	UNKNOWN
218	48.82	0.141	11	UNKNOWN
219	48.95	0.036	10	1,2,3,4-TETRAMETHYLBENZENE(PRENNITENE)
220	49.24	0.032	11	UNKNOWN
221	49.82	0.012	11	UNKNOWN
222	50.04	0.015	11	UNKNOWN
223	50.28	0.052	11	UNKNOWN
224	50.48	0.094	11	UNKNOWN
225	50.57	0.004	11	UNKNOWN
226	60.82	0.017	11	UNKNOWN
227	50.92	0.016	11	UNKNOWN
		100.064		

Table 2

Weight Percentages of PONA Group Types
Found in LCCN by Capillary Gas Chromatography

	Chemical Classes Identified		Weight Percent	
P	Paraffins (C4-C11)			
	normal	4.45 wt.%	43.64	
	isoparaffins	39.19 wt.%		
O	Olefins (C4-C11)		22.73	
N	Naphthenes (C5-C11)		9.69	
A	Aromatics (C6-C10)		24.00	
	(Benzene 0.056 wt.%)			
			100.06	Total

Table 3

Paraffinic Components Identified in LCCN

NORMAL ALKANES

Retention Time (min)	Compound	Weight %
4.66	N-BUTANE	0.226
6.80	N-PENTANE	1.367
11.16	N-HEXANE	1.051
17.98	N-HEPTANE	0.880
25.92	N-OCTANE	0.270
33.91	N-NONANE	0.342
41.20	N-DECANE	0.314
	NORMAL ALKANES, TOTAL	4.45 Wt.%

ISOPARAFFINS

Retention Time (min)	Compound	Weight %
6.11	2-METHYLBUTANE	6.969
8.05	2,2-DIMETHYLBUTANE	0.027
9.35	2,3-DIMETHYLBUTANE	1.331
9.55	2-METHYLPENTANE	4.110
10.26	3-METHYLPENTANE	2.474
12.65	2,2-DIMETHYLPENTANE	0.026
13.01	2,4-DIMETHYLPENTANE	0.619
15.59	2-METHYLHEXANE	2.175
15.73	2,3-DIMETHYLPENTANE	0.599
16.22	3-METHYLHEXANE	2.049
17.13	2,2,4-TRIMETHYLPENTANE	0.803
19.84	2,2-DIMETHYLHEXANE	0.148
20.64	2,5-DIMETHYLHEXANE	0.452
20.78	2,4-DIMETHYLHEXANE	0.104
21.52	3,3-DIMETHYLHEXANE	0.091
21.98	2,3,4-TRIMETHYLPENTANE	0.475
22.77	2,3-DIMETHYLHEXANE	0.278
23.22	2-METHYLHEPTANE	1.219
23.33	4-METHYLHEPTANE	0.400
23.53	3,4-DIMETHYLHEXANE	0.140
23.85	3-METHYLHEPTANE	1.448
24.65	2,2,5-TRIMETHYLHEXANE	0.117
28.91	2,6-DIMETHYLHEPTANE	0.320
31.23	2-METHYLOCTANE	1.033
31.39	3-ETHYLHEPTANE	0.157
31.81	3-METHYLOCTANE	0.703
	OTHER MINOR ISOPARAFFINS	10.920
	ISOPARAFFINS, TOTAL	39.187

Table 4

Olefinic Components Identified in LCCN

Retention Time (min)	Compound	Weight %
4.78	1-BUTENE	0.373
4.90	TRANS-2-BUTENE	0.630
5.11	CIS-2-BUTENE	0.691
5.70	3-METHYL-1-BUTENE	0.226
6.47	1-PENTENE	0.761
6.65	2-METHYL-1-BUTENE	1.261
6.94	ISOPRENE	0.061
7.02	TRANS-2-PENTENE	1.924
7.28	CIS-2-PENTENE	1.073
7.45	2-METHYL-2-BUTENE	2.577
8.78	3-METHYL-1-PENTENE	0.366
8.98	2,3-DIMETHYL-1-BUTENE	0.182
10.48	1-HEXENE	0.851
11.24	TRANS-3-HEXENE	0.434
11.41	TRANS-2-HEXENE	0.875
11.55	2-METHYL-2-PENTENE	0.894
11.74	3-METHYL-2-PENTENE	0.772
12.34	3,3-DIMETHYL-1-PENTENE	0.886
16.93	1-HEPTENE	1.016
18.81	2,4,4-TRIMETHYLPENTENE	0.217
24.98	1-OCTENE	0.326
	OTHER MINOR OLEFINIC COMPONENTS	6.330
	TOTAL	22.726

Table 5

Naphthenic or Cycloalkane Components Identified in LCCN

Retention Time (min)	Compound	Weight %
8.90	CYCLOPENTENE	0.120
11.96	4-METHYLCYCLOPENTENE	0.609
12.85	METHYLCYCLOPENTANE	2.259
15.00	CYCLOHEXENE	0.307
15.95	1,1-DIMETHYLCYCLOPENTANE	0.029
19.68	METHYLCYCLOHEXANE	0.953
20.51	ETHYLCYCLOPENTANE	0.692
21.17	1,2,4-TRIMETHYLCYCLOPENTANE	0.291
21.75	1,2,3-TRIMETHYLCYCLOPENTANE	0.215
24.20	CIS-1,3-DIMETHYLCYCLOHEXANE	0.482
24.33	TRANS-1,4-DIMETHYLCYCLOHEXANE	0.144
25.46	CYCLOHEPTANE	0.250
25.92	TRANS-1,2-DIMETHYLCYCLOHEXANE	0.270
28.74	ETHYLCYCLOHEXANE	0.107
35.58	CYCLOOCTANE	0.095
44.90	DICYCLOHEXYL	0.140
48.42	CIS-CYCLODECENE	0.026
	OTHER MINOR NAPHTHENIC COMPONENTS	2..700
	TOTAL	9.690

Table 6

Aromatic Components Identified in LCCN

Retention Time (min)	Compound	Weight %
14.90	BENZENE	0.056
22.42	TOLUENE	4.585
30.03	ETHYLBENZENE	1.501
30.82	P&M-XYLENES	5.620
32.61	O-XYLENE	2.033
35.06	ISOPROPYLBENZENE(CUMENE)	0.118
37.39	N-PROPYLBENZENE	0.474
38.01	1-METHYL-3-ETHYLBENZENE	1.924
38.15	1-METHYL-4-ETHYLBENZENE	0.793
38.54	1,3,5-TRIMETHYLBENZENE(MESITYLENE)	1.008
39.27	1-METHYL-2-ETHYLBENZENE(2-ETHYLTOLUENE)	0.656
40.38	1,2,4-TRIMETHYLBENZENE (PSEUDOCUMENE)	2.900
41.29	ISOBUTYLBENZENE	0.084
42.10	1,2,3-TRIMETHYLBENZENE(HEMIMELITENE)	0.774
42.33	P-CYMENE	0.026
42.98	INDENE	0.117
43.35	INDAN	0.120
43.99	1,4-DIETHYLBENZENE	0.219
44.10	N-BUTYLBENZENE	0.558
44.32	1,2-DIETHYLBENZENE	0.097
47.25	1,2,4,5-TETRAMETHYLBENZENE (DURENE)	0.124
47.43	1,2,3,5-TETRAMETHYLBENZENE(ISODURENE)	0.184
48.95	1,2,3,4-TETRAMETHYLBENZENE(PREHNITENE)	0.036
	TOTAL	24.007

Table 7

Classification of LCCN
Components by Number of Carbons

Carbon Number	P + O + N	Aromatics	Total
C4	2.00 wt.%	____	2.00 wt.%
C5	16.44	____	16.44
C6	16.70	0.06 wt.%	16.76
C7	16.93	4.58	21.51
C8	11.95	9.15	21.10
C9	7.43	8.88	16.31
C10	3.45	1.33	4.78
C11	0.93	____	0.93
TOTAL	76.06	24.00	100.06 wt.%

WEEKLY TIME SHEET

Employee Name:		**David Lax**			**Title:**			
					Status:	Full-time		
Departmer		**RASA**			**Supervisor:**		**Howard J. Feldman**	
Date	**Vacation**	**Sick**	**Other**	**Type**	**Regular Hrs.**	**Xtra-Time**	**Type**	**Total Hrs.**
07/16/08					7.00			7.00
07/17/08					7.00			7.00
07/18/08					7.00			7.00
07/19/08								
07/20/08								
07/21/08					7.00			7.00
07/22/08					7.00			7.00
07/23/08					7.00			7.00
07/24/08					7.00			7.00
07/25/08					7.00			7.00
07/26/08								
07/27/08								
07/28/08					7.00			7.00
07/29/08					7.00			7.00
07/30/08					7.00			7.00
07/31/08					7.00			7.00
	0.00	0.00	0.00		84.00			84.00

Employee Signature: **Date:** 7/30/08

Supervisor Signature: **Date:**

Other Hours Taken:
X for Summer Hours
B = Bereavement
D = Short Term Disability
FH = Floating Holiday
H = Holiday
J = Jury Duty
L = Leave w/o pay

CAS# 64741-55-5

CHEMICAL CHARACTERIZATION STUDIES OF [redacted] LIGHT CATALYTICALLY CRACKED NAPHTHA (LCCN) (CRU No. 86045)

STUDY NO.: 62781

MATERIAL TESTED:	[redacted] Light Catalytically Cracked Naphtha (CRU No. 86045)
STUDY NO.:	62781
REQUESTOR DIVISION:	US M&R, Manufacturing
STUDY PERFORMED BY:	Mobil Environmental and Health Science Laboratory, P.O. Box 1029, Princeton, NJ 08540
DATE OF REPORT:	January 12, 1989

[redacted] [redacted]

STUDY DIRECTOR SUPERVISOR

DISTRIBUTION:

Study Director: [redacted]

Supervisor, Metabolism/ Pharmacokinetics: [redacted]

Section Manager, Mammalian Toxicology: [redacted]

Director of Toxicology: [redacted]

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SUMMARY

Characterization studies of refinery streams are important since they provide a rational and quantitative basis by which chemical compositional data can be used to evaluate potential toxicity. Standard ASTM mass spectrometric (EIMS) and elemental analyses were carried out on [redacted] light catalytically cracked naphtha (LCCN) to identify and quantitate the amounts of non-aromatic and aromatic components present and to estimate the amounts of total nitrogen, basic nitrogen and sulfur present in this test material. The characterization studies were performed at Paulsboro (Analytical Services) because these analytical tests were not available at MEHSL. The chemical composition results from this study will be utilized by EHS (Toxicology and Product Safety), Medical and MRDC to prioritize refinery streams from various processes and refinery locations for follow-up toxicological evaluation.

The chemical classes of compounds identified in [redacted] light catalytically cracked naphtha are summarized in the table below:

Chemical Composition of [redacted] Light Catalytically Cracked Naphtha (CRU No. 86045)

Class Type		Weight Percent
Non-Aromatics (paraffins, olefinics and napthenics)		76.0 wt.% *
Aromatics		24.0 wt.% *
Monoaromatics	24.0 wt.%	
Diaromatics	Not detected	
> 3-Ring PACs	Not detected	
Aromatic Sulfur-PACs	< 0.23 (estimated)	
[Nitrogen-PACs, non-basic carbazole-type		Not Detected
Nitrogen-PACs, basic quinoline-type		< 0.03 wt.% (estimated)]

* estimated from PONA analysis using GC-FID

Element	Concentration or %
Total Nitrogen	22 ppm
Basic Nitrogen	22 ppm
Total Sulfur	<0.05 %

The column separation performed on LCCN at Paulsboro did not provide sufficient material for carrying out mass spectral analysis of the non-aromatics and aromatics (due to volatiles). Therefore, the amount of non-aromatics and aromatics in LCCN was estimated from PONA (paraffin, olefin, naphthene, aromatic) analysis carried out at MEHSL. Paraffins, olefinics and naphthenics comprised about 76.0% of LCCN while monoaromatics made up about 24.0% of LCCN. Diaromatics (e.g., naphthalenes, biphenyls) and 3-ring PACs were not detectable by GC analysis. Elemental analysis showed that total nitrogen was present at 22 ppm and was basic in nature. Nitrogen-containing organic compounds were calculated to comprise no more than 0.23 wt.% of LCCN based on elemental analysis and on the

assumption of an average molecular weight of 150 for these compounds. Total sulfur was found to be present in LCCN at less than 0.05%.

Chemical characterization studies are important in risk assessment since they provide structural information on the types of compounds present in the test material that may pose potential health risk. LCCN was found to be comprised primarily of volatile, low molecular weight paraffinics, olefinics, naphthenics and monoaromatics that present little if any health concern.

INTRODUCTION

In evaluating the health risks associated with refinery stream materials, it is important to firmly establish the chemical composition of the test materials. There are several reasons for carrying out detailed chemical characterization studies. First, refinery streams are very complex mixtures containing hundreds of components which are present at varying concentrations and which may have varying degrees of toxicity. Knowledge of the major classes of compounds present in the refinery stream and their relative concentrations is important in assessing potential toxicity based on chemical structure. Secondly, since different samples of the same generic refinery stream may vary somewhat depending on the severity of the refinery process and on the refinery location, it is very important to establish the chemical composition of the actual samples being utilized in toxicological studies. Thirdly, if the chemical identity of the major components is established, this greatly aids in formulating safety guidelines for handling these materials and industrial hygiene policies to be followed in the workplace should accidental exposure occur.

The purpose of this study is to establish the chemical composition of [redacted] light catalytically cracked naphtha (CRU No. 86045). This test material is one of many refinery streams from various processes and refinery locations being prioritized by Environmental Health and Safety, Medical and MRDC for possible follow-up toxicological evaluation. The chemical composition found for [redacted] LCCN will be compared with those of other refinery streams as part of an overall safety program to identify and rank those refinery streams that might present a serious health risk. In order to establish a uniform chemical composition database useful to both petroleum chemists and toxicologists, characterization studies were carried out utilizing standard Mobil or ASTM procedures for the determination of non-aromatics and aromatics (silica gel fractionation and mass spectral analysis of aromatics) and employing standard elemental analyses for the estimation of the total amount of nitrogen, basic nitrogen and sulfur present in the test material. Since EIMS and elemental analyses are not available at MEHSL, characterization studies of [redacted] LCCN were carried out by the analytical group at Paulsboro. This report summarizes and interprets the findings of the chemical characterization studies as they pertain to toxicology and health safety.

MATERIALS AND METHODS

Chemicals and Test Materials

The light catalytically cracked naphtha sample (CRU No. 86045) was obtained from the [redacted] and was dispensed by the Chemical Repository Unit (CRU) at MEHSL. The TSCA petroleum process term for light catalytically cracked naphtha is naphtha (petroleum), light catalytic cracked and the CAS Number for this material is 64741-55-5. The test material was dispensed in amber-colored bottles and was kept in the freezer until sent to Paulsboro for analysis. A 25-30 gram sample was sent to Paulsboro [redacted] for analysis.

Chemical Characterization Studies at Paulsboro

Characterization studies and elemental analyses of [redacted] LCCN were performed by the analytical services group at Paulsboro, NJ. Generally, estimation of non-aromatics and aromatics in refinery stream materials is carried out using Mobil Method 1085 "Aromatics and Non-Aromatics in Non-Volatile Distillates". The method utilizes a silica gel chromatographic elution method to separate the non-aromatics from the aromatics (see appendix for additional information on the method). For light refinery streams like LCCN, this method would not be expected to yield sufficient material for mass spectral analysis after separation and evaporation of the eluting solvents.

Because of the volatility of LCCN components did not make this material suitable for column chromatography separation and MS analysis, non-aromatic and aromatic components in LCCN was estimated by GC-FID analysis (PONA analysis) previously carried out at MEHSL on a similar [redacted] LCCN sample. Analytical details and chemical composition data are described in Study No. 41161.

Elemental analysis for total nitrogen in [redacted] LCCN was carried out using a chemiluminescence technique (Mobil Method 1208). Determination of basic nitrogen in the test material was achieved using a perchloric acid-potentiometric titration method (Mobil Method 993-1). Total sulfur was determined using the ASTM method D1552 in which the sulfur is oxidized to sulfur dioxide and then quantitated by iodate titration. Experimental details of the elemental analyses are given in the appendix.

Submission of the LCCN sample to Paulsboro analytical laboratory was primarily to obtain elemental analysis on the amount of nitrogen and sulfur present; this is part of a correlation study examining relative toxicities of light and heavy refinery streams and the contribution of heterocyclic and carbocyclic components to possible adverse toxic effects observed in acute and subchronic animal experiments.

RESULTS AND DISCUSSION

Non-Aromatic and Aromatics in [redacted] LCCN

Silica gel chromatographic separation studies did not yield sufficient material for mass spectral analysis as would be expected due to the nature of the separation method and the volatility of LCCN components. Table 1 summarized the PONA breakdown of paraffinic, olefinic, naphthenic and aromatic components in [redacted] LCCN as estimated from PONA analysis and was reported previously in Study No. 41161. Alkylbenzene compounds (less than 10 carbons) were identified as the aromatic components. There is no evidence that diaromatics or triaromatics are present in LCCN by GC-FID analysis; naphthalene and biphenyl standards were available for GC retention time comparison.

Elemental Analysis - Nitrogen and Sulfur

Elemental analyses were carried out on [redacted] LCCN to estimate the amounts of organonitrogen and organosulfur compounds present in the test material. Of particular toxicological interest are the non-basic carbazole-type derivatives and the basic quinoline- and acridine-type nitrogen PACs. Findings from the elemental analyses showed that total nitrogen was present only at 22 ppm and was basic in nature (Table 2). It was assumed that the organonitrogen components comprise the total nitrogen content in [redacted] LCCN. Elemental analysis also indicated that [redacted] LCCN contained less than 0.05% sulfur.

Calculations were carried out at MEHSL using the elemental composition of nitrogen to estimate the weight % of organic nitrogen compounds present in [redacted] LCCN. An average molecular weight of 150 (2- to 3-ring size) was assumed for these compounds in the calculations. Based on our calculations, it was estimated that organic nitrogen components made up less than 0.03 wt.% of [redacted] LCCN. It should be pointed out that these values are only rough estimations of the weight percentages of organonitrogen compounds present in the test material.

Toxicological Significance of Chemical Classes Found in [redacted] LCCN

Chemical characterization studies are important in risk assessment since they provide structural information to the types of compounds present in the test material that may pose potential health risk. LCCN was found to be comprised primarily of volatile, low molecular weight paraffinics, olefinics, naphthenics and monoaromatics that present little if any health concern (see ref. 1-3 for review of toxicology of these chemcial classes). Very little nitrogen or sulfur components could be detected in LCCN.

Acknowledgement

We wish to thank [redacted] for their assistance in carrying out the chemical characterization studies and elemental analyses at Paulsboro.

REFERENCES

1. E. Browning's Toxicity and Metabolism of Industrial Solvents, 2nd Edition, **Vol. 1**, Hydrocarbons, R. Snyder (ed.), Elsevier, Amsterdam (1987).

2. E.E. Sandmeyer, Aromatic Compounds *in* Patty's Industrial Hygiene and Toxicology, **Vol 2B**, G.D. Clayton and F.E. Clayton (eds.), John Wiley & Sons, pp. 3253-3431 (1981).

3. H.W. Gerarde, Toxicology and Biochemistry of Aromatic Hydrocarbons, Elsevier, Amsterdam, 1960.

Table 1

Estimation of Non-Aromatic and Aromatic Chemical Classes in [redacted]CCN (CRU No. 86045)

Chemical Class		Weight % of Total Sample
Non-Aromatics (Paraffins, olefins and naphthenes)		76.0 wt.% *
Aromatics		24.0 wt.% *
Monoaromatics	24.0 wt.% *	
Diaromatics	Not Detected	
> 3-Ring PACs	Not Detected	
Total =		100.0 wt.%

* Estimated from PONA analysis using GC-FID (see text)

Table 2

Elemental Analysis of [redacted]
Light Catalytically Cracked Naphtha (CRU No. 86045)

Element	Concentration or %
Total Nitrogen	22 ppm
Basic Nitrogen	22 ppm
Total Sulfur	< 0.05 %

Chemical Class	Estimated Weight %
Non-Basic Nitrogen Organics (e.g. carbazole derivatives)[a]	Not Detected
Basic Nitrogen Organics (e.g. quinoline derivatives)[a]	< 0.03 Wt.% [a]

[a] Estimation of organonitrogen compounds was obtained assuming an average MW of 150 for these compounds and calculating the theoretical wt.% based on elemental analysis findings. MW of 150 was used to be consistent with calculations for heavier refinery streams. It is recognized that LCCN may contain lower MW components (<150 amu). See text and appendix for calculations.

Appendix

Calculation of Non-Basic and Basic-NPAC Content (Wt.%) in [redacted] LCCN (CRU No. 86045)

Non-Basic Nitrogen

Total Non-Basic Nitrogen = 0 ppm = 0 wt.%

Amount of Non-Basic N-PAC of average MW 150 (i.e. 2- to 3-ring size) that will give a total nitrogen value of 0.0 wt.% on elemental analysis

$$[\text{Non-Basic NPAC}] = \frac{0.0}{14/150} = 0.00 \text{ wt.\%}$$

Basic Nitrogen

Total Basic Nitrogen = 22 ppm = 0.0022 wt.%

Amount of Basic N-PAC of average MW 150 (i.e. 2- to 3-ring size) that will give a total nitrogen value of 0.0022 wt.% on elemental analysis

$$[\text{Basic NPAC}] = \frac{0.0022}{14/150} = 0.024 \text{ wt.\%}$$

Sulfur

Total Sulfur = < 0.05 %

Amount of Sulfur PAC of average MW 150 (i.e. 2- to 3-ring size) that will give a total sulfur value of 0.05 % on elemental analysis

$$[\text{Sulfur PAC}] = \frac{0.05}{32/150} = 0.23 \text{ wt.\%}$$

ATX-92-0126

F-184

ATX-92-0126

CONSCI

ARCO
Environment, Health & Safety
515 South Flower Street
Los Angeles, California 90071

December 31, 1992

Attn: Francis J. Koschier, Ph.D.

Invoice #: 100303

Certificate #: 21207010
Sample ID: F-184
Date Received: December 7, 1992

CAS# 64741-68-0

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.7990	---	ECB	12/08/92
Refractive Index	D-1218	1.4635	---	RDP	12/15/92
Avg. Mol. Wt	GPSA	117	---	WMG	12/13/92
Sulfur (MC)	D-3120	2	ppm/wt.	TES	12/15/92
Total Oxygen	Neut. Act.	< 0.01	wt.%	WDJ	12/17/92
Carbon	Calc.	88.36	wt.%	WMG	12/30/92
Hydrogen	Calc.	11.64	wt.%	WMG	12/30/92
Nitrogen	D-4629	1	ppm/wt	JWT	12/16/92
Viscosity	D-445				
100 F		0.57	cst.	RDP	12/18/92
122 F		0.53	cst.	RDP	12/18/92
210 F		0.40	cst.	RDP	12/18/92
Pour Point	D-97	<-76	°F	DCM	12/17/92
Existent Gum	D-381				
Washed		1.6	mg/100ml	DCM	12/16/92
Unwashed		6.8	mg/100ml	DCM	12/16/92

10001890 **ATX-920126**

ARCO
Certificate #: 21207010
Sample ID: F-184

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.2	mg/kg	GAB	12/21/92
Copper	220.1	< 0.1	mg/kg	GAB	12/21/92
Iron	236.1	0.92	mg/kg	GAB	12/21/92
Nickel	249.1	< 0.1	mg/kg	GAB	12/21/92
Sodium	273.1	15.4	mg/kg	GAB	12/21/92
Vanadium	286.1	< 1.0	mg/kg	GAB	12/21/92
Arsenic	206.3	< 0.002	mg/kg	GAB	12/21/92
Chromium	218.1	< 0.1	mg/kg	GAB	12/21/92

CERTIFICATE OF ANALYSIS-METHOD 8270

PARAMETER	RESULTS	UNITS	ANALYST	DATE
POLYNUCLEAR AROMATICS:				
Naphthalene	918	mg/kg	DMK	12/11/92
2-Methylnaphthalene	973	mg/kg	DMK	12/11/92
1-Methylnaphthalene	419	mg/kg	DMK	12/11/92
Acenaphthylene	3	mg/kg	DMK	12/11/92
Acenaphthene	14	mg/kg	DMK	12/11/92
Fluorene	20	mg/kg	DMK	12/11/92
Phenanthrene	80	mg/kg	DMK	12/11/92
Anthracene	7	mg/kg	DMK	12/11/92
Fluoranthene	10	mg/kg	DMK	12/11/92
Pyrene	21	mg/kg	DMK	12/11/92
Benzo(a)anthracene	8	mg/kg	DMK	12/11/92
Chrysene	8	mg/kg	DMK	12/11/92
Benzo(b)fluoranthene	10	mg/kg	DMK	12/11/92
Benzo(k)fluoranthene	10	mg/kg	DMK	12/11/92
Benzo(a)pyrene	6	mg/kg	DMK	12/11/92
Dibenzo(a,h)anthracene	< 10	mg/kg	DMK	12/11/92
Benzo(g,h,i)perylene	12	mg/kg	DMK	12/11/92
Ideno(1,2,3-cd)pyrene	< 10	mg/kg	DMK	12/11/92

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
Isobutane	0.16	0.23
n-Butane	1.24	1.69
2,2-Dimethylpropane	0.01	0.01
Isopentane	3.31	4.23
n-Pentane	2.65	3.35
2,2-Dimethylbutane	0.05	0.06
Cyclopentane	0.13	0.14
2,3-Dimethylbutane	0.27	0.32
2-Methylpentane	1.70	2.06
3-Methylpentane	1.25	1.49
n-Hexane	2.11	2.54
2,2-Dimethylpentane	0.03	0.04
Methylcyclopentane	0.47	0.50
2,4-Dimethylpentane	0.23	0.27
Benzene	3.05	2.84
3,3-Dimethylpentane	0.03	0.03
Cyclohexane	0.13	0.13
2-Methylhexane	1.68	1.96
2,3-Dimethylpentane	0.40	0.46
1,1-Dimethylcyclopentane	0.06	0.06
3-Methylhexane	2.11	2.44
t-1,3-Dimethylcyclopentane	0.08	0.08
c-1,3-Dimethylcyclopentane	0.08	0.09
3-Ethylpentane	0.23	0.26
t-1,2-Dimethylcyclopentane	0.14	0.15
n-Heptane	2.75	3.19
c-1,2-Dimethylcyclopentane + Methylcyclohexane	0.29	0.30
2,2-Dimethylhexane + 113 TMCP	0.04	0.05
Ethylcyclopentane	0.28	0.29
2,2,3-Trimethylpentane + 2,4-Dimethylpentane	0.33	0.37
1,2,4-Trimethylcyclopentane	0.04	0.04
3,3-Dimethylhexane	0.01	0.01
1,2,3-Trimethylcyclopentane	0.03	0.03
2,3,4-Trimethylpentane	0.01	0.01
Toluene	18.26	16.72
2,3-Dimethylhexane	0.17	0.19
C8 Naphthene + C8 Paraffin	0.05	0.05

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
2-Methylheptane	0.99	1.13
4-Methylheptane	0.47	0.53
C8 Paraffin	0.10	0.11
3-Methylheptane	1.16	1.30
3-Ethylhexane + c-1,4-Dimethylcyclohexane	0.31	0.31
C8 Naphthene	0.01	0.01
C9 Paraffin	0.02	0.02
C8 Naphthene	0.04	0.04
C8 Naphthene	0.04	0.04
C8 Naphthene	0.05	0.05
n-Octane	1.54	1.74
C8 Naphthene	0.01	0.01
C9 Naphthene	0.01	0.01
C9 Paraffin	0.02	0.02
Isopropylcyclopentane	0.02	0.02
C9 Paraffin	0.02	0.02
c-1,2-Dimethylcyclohexane	0.11	0.11
C9 Paraffin	0.01	0.01
C9 Naphthene	0.16	0.16
C9 Naphthene	0.26	0.27
C9 Naphthene	0.05	0.05
Ethylbenzene	4.12	3.77
C9 Naphthene	0.01	0.01
m-Xylene	9.71	8.92
p-Xylene	3.53	3.26
C9 Paraffin	0.08	0.09
2-Methyloctane	0.36	0.40
4-Methyloctane	0.36	0.40
3-Ethylheptane	0.11	0.12
3-Methyloctane	0.46	0.51
o-Xylene	4.59	4.14
Naphthene	0.02	0.02
Naphthene	0.02	0.02
C9 Naphthene	0.03	0.03
Unidentified C9's	0.04	0.04
n-Nonane	0.68	0.75
C9 Naphthene	0.01	0.01
Isopropylbenzene	0.22	0.20

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
C9 Dinaphthene	0.01	0.01
C10 Paraffin	0.05	0.05
C10 Paraffin	0.02	0.02
Naphthene	0.05	0.05
C10 Naphthene	0.02	0.02
C10 Paraffin	0.03	0.03
C9 Naphthene	0.04	0.04
C10 Naphthene	0.08	0.08
C10 Paraffin	0.03	0.03
C10 Paraffin	0.02	0.02
n-Propylbenzene	1.27	1.17
1-Methyl-3-ethylbenzene + C10 Paraffin	3.23	2.97
1-Methyl-4-ethylbenzene	1.43	1.32
C10 Naphthene	0.07	0.07
1,3,5-Trimethylbenzene	1.75	1.61
C10 Naphthene + C10 Paraffin	0.06	0.06
4-Methylnonane	0.13	0.14
2-Methylnonane	0.12	0.13
1-Methyl-2-ethylbenzene	0.98	0.88
3-Methylnonane	0.16	0.17
C10 Naphthene	0.01	0.01
C10 Naphthene	0.01	0.01
1,2,4-Trimethylbenzene	4.79	4.34
iso-Butylbenzene	0.09	0.08
sec-Butylbenzene	0.07	0.06
Unidentified C10's	0.03	0.03
n-Decane	0.25	0.27
1,2,3-Trimethylbenzene	0.89	0.79
Indan	0.56	0.46
1,3-Diethylbenzene	0.29	0.27
1-Methyl-3-n-propylbenzene	0.72	0.66
1-Methyl-4-n-propylbenzene	0.42	0.39
n-Butylbenzene	0.23	0.21
1,2-Diethylbenzene	0.63	0.57
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.04	0.04
1-Methyl-2-n-propylbenzene	0.22	0.20
1,4-Dimethyl-2-ethylbenzene	0.34	0.31
1,3-Dimethyl-4-ethylbenzene	0.33	0.30

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
1,2-Dimethyl-4-ethylbenzene	0.62	0.56
1,3-Dimethyl-2-ethylbenzene	0.12	0.11
Unidentified C11's	0.29	0.31
n-Undecane	0.06	0.06
1,2,4,5-Tetramethylbenzene	0.32	0.29
1,2,3,5-Tetramethylbenzene	0.44	0.39
Naphthalene	0.80	0.54
Unidentified C12's	1.53	1.60
n-Dodecane	0.03	0.03
Heavies (nC12 +)	1.61	1.61
Total Olefins	1.10	1.30
Totals	100.00	100.00

Hydrocarbon Type Summary	Wt %	LV %
n-Paraffins	11.31	13.62
Isoparaffins	17.11	20.08
Naphthenes	3.24	3.34
Aromatics	63.74	58.07
Unknowns	3.50	3.59
Olefins	1.10	1.30
Totals	100.00	100.00

ASTM D-1319

	L.V.%
Saturates	38.2
Olefins	1.1
Aromatics	60.7

Michael A. Sommer II, Ph.D.

MAS/ar

Certificate No.: 21207010
Description: F-184
Analysis Date: December 11, 1992
Analyst: PAR

CONSCI

	% Overhead	Deg. F
IBP	0.5	71
	2	87
	4	90
	6	98
	8	136
	10	154
	12	167
	14	182
	16	190
	18	195
	20	202
	22	210
	24	234
	26	236
	28	236
	30	237
	32	237
	34	238
	36	239
	38	239
	40	240
	42	240
	44	241
	46	245
	48	258
	50	280
	52	283
	54	285
	56	286
	58	287
	60	288
	62	288
	64	289
	66	289
	68	291
	70	296
	72	298
	74	301
	76	324
	78	327
	80	328
	82	330
	84	335
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	88	342
	90	351
	92	364
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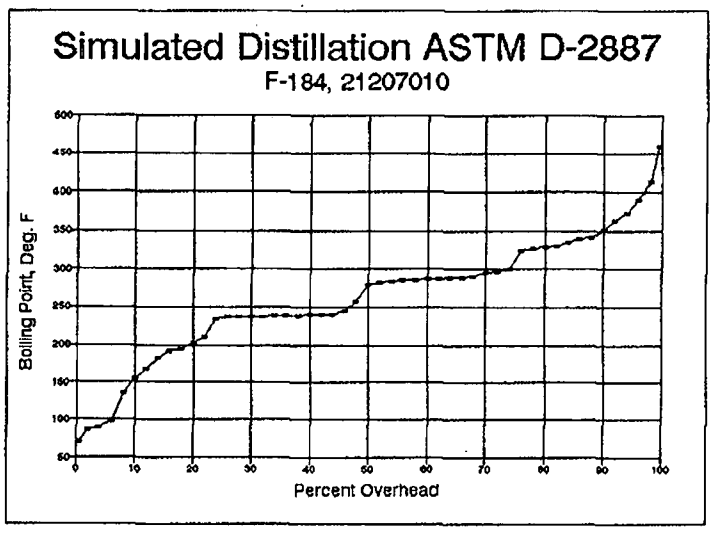
	96	391
	98	413
FBP	99.5	461



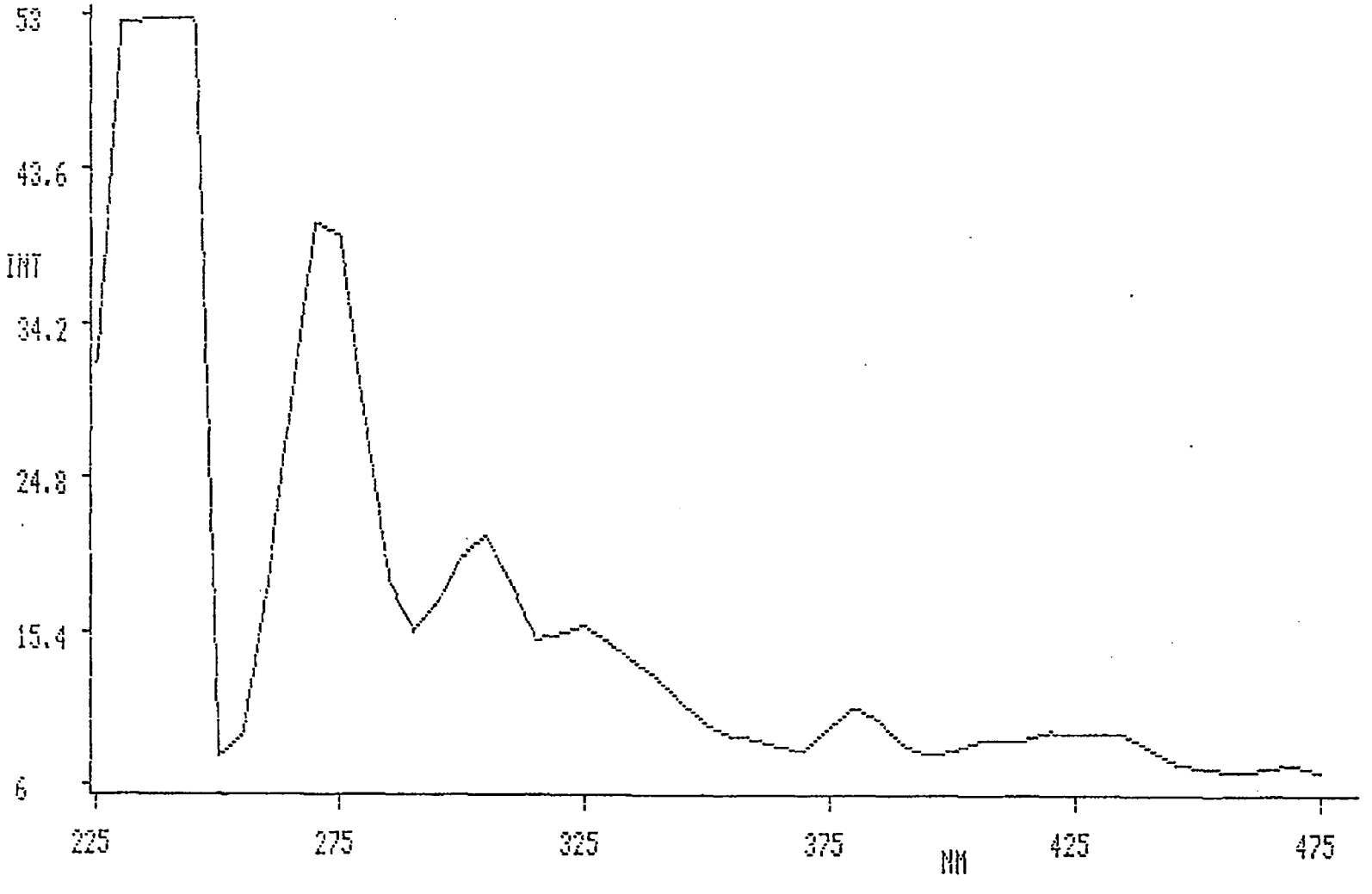
Specific Gravity 0.7990

Average Molecular Wt. 117

CONSOLIDATED SCIENCES, INCORPORATED 1416 SOUTHMORE PASADENA, TEXAS 77502 (713) 920-1696 FAX (713) 920-1648

SYNCHRONOUS FLUORESCENCE

SAMPLE NO. F-184 63 PPM



ATX-93-0159

CONSCI

Arco Corporate Toxicology Dept.
515 South Flower St.
Los Angeles, California 90071

September 21, 1993

Attn: Francis Koschier

Invoice #: 101913
PO #: CS92-001

Certificate #: 30819019
Sample ID: F-251, Sweet Naphtha
Date Received: August 19, 1993

CAS# 64741-87-3

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.6532	---	WMG	08/23/93
Refractive Index	D-1218	1.3759	---	RDP	08/26/93
Avg. Mol. Wt	GPSA	77.1	---	WMG	09/11/93
Sulfur (MC)	D-3120	655	mg/Kg	MY	08/26/93
Total Oxygen	D-4815	< 0.01	wt.%	EB	09/11/93
Carbon	Calc.	84.93	wt.%	WMG	09/11/93
Hydrogen	Calc.	15.07	wt.%	WMG	09/11/93
Nitrogen	D-4629	< 1	mg/Kg	MS	08/31/93
Viscosity	D-445				
100 F		0.38	cst.	DGN	08/27/93
122 F		---	---	---	---
210 F		---	---	---	---
Pour Point	D-97	<-85	°F	DGN	08/27/93
Existent Gum	D-381				
Washed		1.2	mg/100ml	DGN	08/27/93
Unwashed		4.6	mg/100ml	DGN	08/27/93

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.1	mg/kg	GAB	09/07/93
Copper	220.1	< 0.5	mg/kg	GAB	09/07/93
Iron	236.1	0.8	mg/kg	GAB	09/08/93
Nickel	249.1	< 0.05	mg/kg	GAB	09/08/93
Sodium	273.1	17.5	mg/kg	GAB	09/08/93
Vanadium	286.1	< 0.5	mg/kg	GAB	09/08/93
Arsenic	206.3	< 0.001	mg/kg	GAB	09/08/93
Chromium	218.1	< 0.05	mg/kg	GAB	09/08/93

Arco Corporate Toxicology Dept.
Certificate #: 30819019
Sample ID: F-251, Sweet Naphtha
Analysis Date: September 7, 1993
Analyst: MS

CERTIFICATE OF ANALYSIS

Component	Amt. Detected	Detection Limit
Acenaphthene	N.D.	0.1
Acenaphthylene	N.D.	0.1
Anthracene	N.D.	0.1
Benzo(a)anthracene	N.D.	0.1
Benzo(a)pyrene	N.D.	0.1
Benzo(a)fluoranthene	N.D.	0.1
Benzo(ghi)perylene	N.D.	0.1
Benzo(k)fluoranthene	N.D.	0.1
Chrysene	N.D.	0.1
Dibenzo(a,h)anthracene	N.D.	0.1
Fluoranthene	N.D.	0.1
Fluorene	N.D.	0.1
Indeno(1,2,3-cd)pyrene	N.D.	0.1
Naphthalene	N.D.	0.1
Phenanthrene	N.D.	0.1
Pyrene	N.D.	0.1
2-Methylnaphthalene	N.D.	0.1
1-Methylnaphthalene	N.D.	0.1

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
Isobutane	0.02	0.02
Isobutylene + 1-Butene	0.17	0.19
n-Butane	1.43	1.63
trans-2-Butene	0.26	0.28
2,2-Dimethylpropane	0.01	0.01
cis-2-Butene	0.33	0.35
3-Methyl-1-butene	1.06	1.12
Isopentane	7.81	8.33
1-Pentene	6.59	6.80
2-Methyl-1-butene	2.99	3.04
n-Pentane	19.62	20.71
2-Methyl-1,3-butadiene	0.19	0.18
trans-2-Pentene	3.89	3.97
3,3-Dimethyl-1-butene	2.04	2.06
cis-2-Pentene	4.45	4.49
trans-1,3-Pentadiene	0.41	0.40
2,2-Dimethylbutane + Cyclopentadiene + cis-1,3-Pentadiene	0.39	0.40
Cyclopentene	1.34	1.15
4-Methyl-1-pentene	1.48	1.47
3-Methyl-1-pentene	0.74	0.74
Cyclopentane	2.74	2.43
2,3-Dimethyl-1-butene	0.32	0.31
4-Methyl-cis-2-pentene	0.24	0.24
2-Methylpentane	5.45	5.52
4-Methyl-trans-2-pentene	0.84	0.83
1,5-Hexadiene	0.02	0.02
3-Methylpentane	2.14	2.13
a-Hexene	6.43	6.32
n-Hexane + 2-Ethyl-1-butene	10.21	10.24
cis-3-Hexene	0.52	0.51
trans-3-Hexene	0.18	0.18
trans-2-Hexene	1.33	1.30
2-Methyl-2-pentene	1.58	1.52
3-Methylcyclopentene	0.52	0.45
3-Methyl-cis-2-pentene	0.53	0.51
4-Methylcyclopentene	0.28	0.24

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
3-Methyl-trans-2-pentene	0.66	0.63
cis-2-Hexene	0.69	0.66
Methylcyclopentane	2.54	2.25
2,4-Dimethylpentane	0.08	0.08
2,2,3-Trimethyl-1-butene	0.11	0.10
C7 Cyclo-olefin/diolefins	0.55	0.47
1-Methylcyclopentene	1.63	1.38
C7 Olefin	0.16	0.15
Benzene	0.60	0.45
Cyclohexane + C7 olefin	0.51	0.43
C7 Cyclo-olefin/diolefin	0.04	0.03
C7 Cyclo-olefin/diolefin	0.12	0.10
C7 Cyclo-olefin/diolefin	0.23	0.20
C7 Olefin	0.08	0.08
2-Methylhexane	0.37	0.36
2,3-Dimethylpentane + C7 olefin	0.10	0.10
C7 Cyclo-olefin/diolefin	0.27	0.23
3-Methylhexane	0.28	0.27
t-1,3-Dimethylcyclopentane	0.09	0.08
c-1,3-Dimethylcyclopentane	0.08	0.07
t-1,2-Dimethylcyclopentane	0.42	0.37
C7 Olefin	0.04	0.04
n-Heptane	0.41	0.40
C7 Olefin	0.04	0.04
C7 Olefin	0.04	0.04
Methylcyclohexane	0.02	0.02
Unidentified components	1.29	0.88
Totals	100.00	100.00

Hydrocarbon Type Summary	Wt %	LV %
Paraffins	47.71	49.59
Naphthenes	6.30	5.56
Aromatics	0.60	0.45
Olefins	44.10	43.52
Unknowns	1.29	0.88
Totals	100.00	100.00

William M. Geiger/ar.

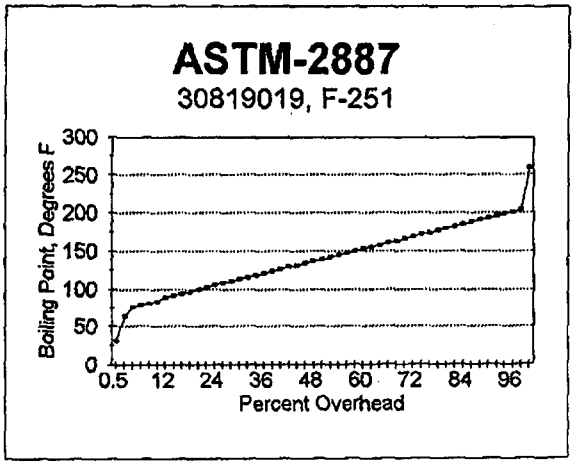
William M. Geiger

WMG/ar

Certificate No.: 30819019
Description: F-251
Analysis Date: September 7, 1993
Analyst: PAR

CONSCI

	% Overhead	Deg. F
IBP	0.5	30
	2	63
	4	76
	6	79
	8	81
	10	84
	12	89
	14	92
	16	94
	18	97
	20	100
	22	102
	24	105
	26	108
	28	110
	30	113
	32	115
	34	118
	36	121
	38	124
	40	126
	42	129
	44	131
	46	134
	48	137
	50	139
	52	142
	54	145
	56	147
	58	150
	60	153
	62	155
	64	158
	66	161
	68	163
	70	166
	72	169
	74	172
	76	174
	78	177
	80	180
	82	182
	84	185
	86	188
	88	191
	90	193
	92	196
	94	199
	96	201
	98	204
FBP	100	259



Specific Gravity 0.6532

Avg. Mol. Wt. 77.1

CONSOLIDATED SCIENCES, INCORPORATED 1416 SOUTHMORE PASADENA, TEXAS 77502 (713) 920-1696 FAX (713) 920-1648

ATX-92-0127

F-185

CAS # 64742-82-1

ATX-92-0127

CONSCI

ARCO
Environment, Health & Safety
515 South Flower Street
Los Angeles, California 90071

December 31, 1992

Attn: Francis J. Koschier, Ph.D.

Invoice #: 100303

Certificate #: 21207011
Sample ID: F-185
Date Received: December 7, 1992

10001891 ATX-920127

CERTIFICATE OF ANALYSIS

CAS # 64742-82-1

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.7660	---	ECB	12/08/92
Refractive Index	D-1218	1.4298	---	RDP	12/16/92
Avg. Mol. Wt	GPSA	126	---	WMG	12/13/92
Sulfur (MC)	D-3120	2	ppm/wt.	TES	12/15/92
Total Oxygen	Neut. Act.	< 0.01	wt.%	WDJ	12/17/92
Carbon	Calc.	86.18	wt.%	WMG	12/30/92
Hydrogen	Calc.	13.82	wt.%	WMG	12/30/92
Nitrogen	D-4629	1	ppm/wt	JWT	12/16/92
Viscosity	D-445				
100 F		0.72	cst.	RDP	12/18/92
122 F		0.65	cst.	RDP	12/18/92
210 F		0.45	cst.	RDP	12/18/92
Pour Point	D-97	<-76	°F	DCM	12/17/92
Existent Gum	D-381				
Washed		0.2	mg/100ml	DCM	12/16/92
Unwashed		0.2	mg/100ml	DCM	12/16/92

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.2	mg/kg	GAB	12/21/92
Copper	220.1	< 0.1	mg/kg	GAB	12/21/92
Iron	236.1	< 0.1	mg/kg	GAB	12/21/92
Nickel	249.1	< 0.1	mg/kg	GAB	12/21/92
Sodium	273.1	15.2	mg/kg	GAB	12/21/92
Vanadium	286.1	< 1.0	mg/kg	GAB	12/21/92
Arsenic	206.3	< 0.002	mg/kg	GAB	12/21/92
Chromium	218.1	< 0.1	mg/kg	GAB	12/21/92

CERTIFICATE OF ANALYSIS-METHOD 8270

PARAMETER	RESULTS	UNITS	ANALYST	DATE
POLYNUCLEAR AROMATICS:				
Naphthalene	55	mg/kg	DMK	12/11/92
2-Methylnaphthalene	7	mg/kg	DMK	12/11/92
1-Methylnaphthalene	3	mg/kg	DMK	12/11/92
Acenaphthylene	< 2	mg/kg	DMK	12/11/92
Acenaphthene	< 2	mg/kg	DMK	12/11/92
Fluorene	< 2	mg/kg	DMK	12/11/92
Phenanthrene	< 2	mg/kg	DMK	12/11/92
Anthracene	< 2	mg/kg	DMK	12/11/92
Fluoranthene	< 2	mg/kg	DMK	12/11/92
Pyrene	< 2	mg/kg	DMK	12/11/92
Benzo(a)anthracene	< 2	mg/kg	DMK	12/11/92
Chrysene	< 2	mg/kg	DMK	12/11/92
Benzo(b)fluoranthene	< 2	mg/kg	DMK	12/11/92
Benzo(k)fluoranthene	< 2	mg/kg	DMK	12/11/92
Benzo(a)pyrene	< 2	mg/kg	DMK	12/11/92
Dibenzo(a,h)anthracene	< 2	mg/kg	DMK	12/11/92
Benzo(g,h,i)perylene	< 2	mg/kg	DMK	12/11/92
Ideno(1,2,3-cd)pyrene	< 2	mg/kg	DMK	12/11/92

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
Isopentane	0.01	0.01
n-Pentane	0.02	0.02
Cyclopentane	0.01	0.01
2,3-Dimethylbutane	0.01	0.01
2-Methylpentane	0.08	0.09
3-Methylpentane	0.09	0.10
n-Hexane	0.57	0.66
2,2-Dimethylpentane	0.03	0.03
Methylcyclopentane	0.57	0.58
2,4-Dimethylpentane	0.07	0.08
2,2,3-Trimethylbutane	0.01	0.01
Benzene	0.36	0.31
3,3-Dimethylpentane	0.03	0.03
Cyclohexane	1.19	1.17
2-Methylhexane	0.90	1.01
2,3-Dimethylpentane	0.35	0.38
1,1-Dimethylcyclopentane	0.18	0.18
3-Methylhexane	1.23	1.37
t-1,3-Dimethylcyclopentane	0.56	0.57
c-1,3-Dimethylcyclopentane	0.66	0.68
t-1,2-Dimethylcyclopentane	1.02	1.04
n-Heptane	4.38	4.89
c-1,2-Dimethylcyclopentane + Methylcyclohexane	7.03	6.96
2,2-Dimethylhexane + 113 TMCP	0.36	0.40
2,5-Dimethylhexane	1.01	1.06
2,2,3-Trimethylpentane + 2,4-Dimethylpentane	0.34	0.37
1,2,4-Trimethylcyclopentane	0.56	0.57
3,3-Dimethylhexane	0.07	0.08
1,2,3-Trimethylcyclopentane	0.66	0.67
2,3,4-Trimethylpentane	0.07	0.07
Toluene	4.95	4.36
2,3-Dimethylhexane	0.27	0.29
C8 Naphthene + C8 Paraffin	0.33	0.33
2-Methylheptane	2.15	2.35
4-Methylheptane	0.65	0.70
C8 Paraffin	0.17	0.19

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
3-Methylheptane	1.40	1.51
3-Ethylhexane + c-1,4-Dimethylcyclohexane	2.35	2.29
C9 Paraffin	0.80	0.84
C8 Naphthene	0.35	0.35
2,2,4-Trimethylhexane	0.37	0.39
C8 Naphthene	0.32	0.32
C8 Naphthene	0.72	0.72
t-1,2-Dimethylcyclohexane	1.11	1.09
n-Octane	5.12	5.56
C8 Naphthene	0.20	0.20
C9 Paraffin	0.12	0.13
Isopropylcyclopentane	0.58	0.57
C9 Paraffin	0.43	0.45
c-1,2-Dimethylcyclohexane	0.34	0.33
C9 Paraffin	0.02	0.02
C9 Paraffin	1.31	1.38
C9 Paraffin	2.01	2.11
C9 Naphthene	0.06	0.06
C9 Paraffin	1.99	2.09
C9 Naphthene	0.06	0.06
C9 Paraffin	0.22	0.23
C9 Naphthene	0.12	0.12
C9 Naphthene	0.16	0.16
C9 Naphthene	0.17	0.17
C9 Naphthene	0.12	0.12
Ethylbenzene	1.64	1.44
C9 Naphthene	0.49	0.48
C9 Naphthene	0.09	0.09
C9 Naphthene	0.04	0.04
m-Xylene	3.83	3.39
p-Xylene	1.09	0.97
C9 Paraffin	0.07	0.07
C9 Paraffin	0.10	0.11
2-Methyloctane	1.02	1.09
4-Methyloctane	0.86	0.91
3-Ethylheptane	0.26	0.28
3-Methyloctane	1.09	1.16

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
C10 Naphthene	0.19	0.18
C9 Naphthene	0.08	0.08
C9 Naphthene	0.10	0.10
C9 Naphthene	0.01	0.01
o-Xylene	1.75	1.52
C9 Naphthene	0.02	0.02
C9 Naphthene	0.54	0.53
C9 Naphthene	0.87	0.86
C9 Naphthene	0.40	0.39
C9 Naphthene	0.13	0.13
Naphthene	0.09	0.09
Naphthene	0.17	0.17
Unidentified C9's	0.05	0.05
n-Nonane	4.50	4.79
C9 Naphthene	0.86	0.85
C9 Naphthene	0.02	0.02
C9 Naphthene	0.02	0.02
Isopropylbenzene	0.28	0.25
C10 Paraffin	0.74	0.77
C10 Paraffin	0.46	0.48
Naphthene	0.09	0.09
C10 Naphthene	0.06	0.06
C10 Paraffin	0.14	0.15
C9 Naphthene	0.06	0.06
C10 Naphthene	0.16	0.15
C10 Paraffin	0.18	0.19
C10 Paraffin	0.97	1.01
C10 Naphthene	0.09	0.09
C10 Naphthene	0.38	0.36
C10 Naphthene	0.05	0.05
C10 Paraffin	0.83	0.87
C10 Paraffin	0.50	0.52
n-Propylbenzene	1.13	1.00
C10 Naphthene + C10 Paraffin	0.22	0.21
Naphthene	0.10	0.10
Naphthene	0.09	0.09
1-Methyl-3-ethylbenzene + C10 Paraffin	1.01	0.89
1-Methyl-4-ethylbenzene	0.57	0.51

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
C10 Naphthene	0.20	0.19
1,3,5-Trimethylbenzene	0.87	0.77
C10 Naphthene	0.07	0.07
4-Methylnonane	0.32	0.33
2-Methylnonane	0.66	0.69
Naphthene	0.04	0.04
3-Ethyloctane	0.60	0.62
1-Methyl-2-ethylbenzene	0.58	0.50
3-Methylnonane	0.54	0.56
C10 Naphthene	0.25	0.24
C10 Naphthene	0.18	0.17
t-Butylbenzene	0.20	0.18
1,2,4-Trimethylbenzene	1.72	1.50
C10 Naphthene	0.27	0.26
C10 Naphthene	0.43	0.41
C10 Naphthene	0.09	0.09
C10 Naphthene	0.11	0.10
iso-Butylbenzene	0.14	0.13
sec-Butylbenzene	0.20	0.18
Unidentified C10's	0.51	0.52
n-Decane	3.36	3.51
C10 Naphthene	0.20	0.19
1,2,3-Trimethylbenzene	0.63	0.54
1-Methyl-3-isopropylbenzene	0.11	0.10
1-Methyl-4-isopropylbenzene	0.11	0.10
Naphthene	0.15	0.14
Indan	0.06	0.05
C11 Paraffin	0.98	1.00
C11 Paraffin	0.20	0.20
1-Methyl-2-isopropylbenzene	0.49	0.43
C11 Paraffin	0.20	0.20
1,3-Diethylbenzene	0.14	0.12
1-Methyl-3-n-propylbenzene	0.24	0.21
C11 Paraffin	0.48	0.49
1-Methyl-4-n-propylbenzene	0.17	0.15
n-Butylbenzene	0.16	0.14
1,2-Diethylbenzene	0.39	0.34
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.10	0.09

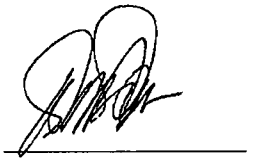
CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
C11 Paraffin	0.23	0.24
1-Methyl-2-n-propylbenzene	0.26	0.23
C11 Paraffin	0.26	0.27
C11 Paraffin	0.30	0.31
1,4-Dimethyl-2-ethylbenzene	0.27	0.24
1,3-Dimethyl-4-ethylbenzene	0.18	0.16
C11 Paraffin	0.30	0.31
1,2-Dimethyl-4-ethylbenzene	0.36	0.31
Unidentified C11's	0.44	0.45
n-Undecane	0.17	0.17
1,2,4,5-Tetramethylbenzene	0.12	0.10
1,2,3,5-Tetramethylbenzene	0.12	0.10
C12 Paraffins	0.36	0.36
C11 & C12 Indans	0.02	0.02
C11 Aromatics	0.07	0.06
Naphthalene	0.03	0.02
Unidentified C12's	0.35	0.34
n-Dodecane	0.02	0.02
Heavies (nC12 +)	0.07	0.07
Total Olefins	0.03	0.03
Totals	100.00	100.00

Hydrocarbon Type Summary	Wt. %	LV %
n-Paraffins	18.14	19.62
Isoparaffins	29.51	31.20
Naphthenes	26.65	26.40
Aromatics	24.25	21.32
Unknowns	1.42	1.43
Olefins	0.03	0.03
Totals	100.00	100.00

ASTM D-1319

	L.V.%
Saturates	81.3
Olefins	2.1
Aromatics	16.6



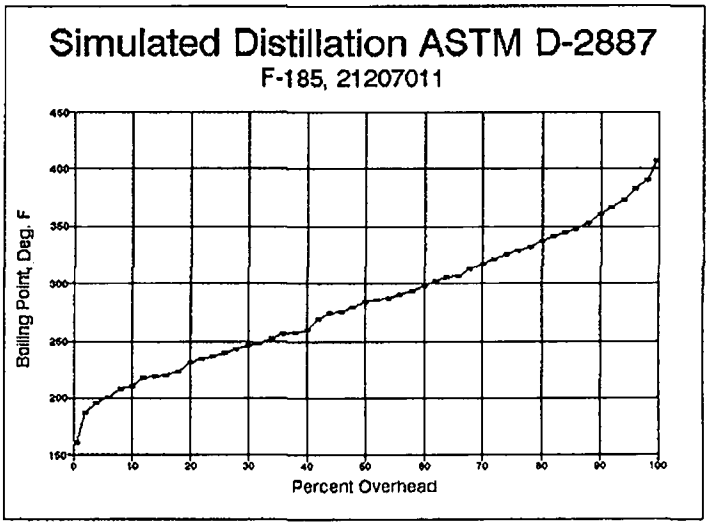
Michael A. Sommer II, Ph.D.

MAS/ar

CONSCI

Certificate No.: 21207011
Description: F-185
Analysis Date: December 11, 1992
Analyst: PAR

	% Overhead	Deg. F
IBP	0.5	161
	2	187
	4	195
	6	201
	8	208
	10	210
	12	217
	14	219
	16	220
	18	223
	20	231
	22	235
	24	237
	26	240
	28	243
	30	246
	32	248
	34	253
	36	257
	38	258
	40	260
	42	270
	44	274
	46	276
	48	280
	50	284
	52	286
	54	287
	56	290
	58	294
	60	298
	62	302
	64	305
	66	307
	68	312
	70	317
	72	321
	74	325
	76	329
	78	332
	80	337
	82	341
	84	345
	86	348
	88	353
	90	360
	92	366
	94	373
	96	383
	98	390
FBP	99.5	407

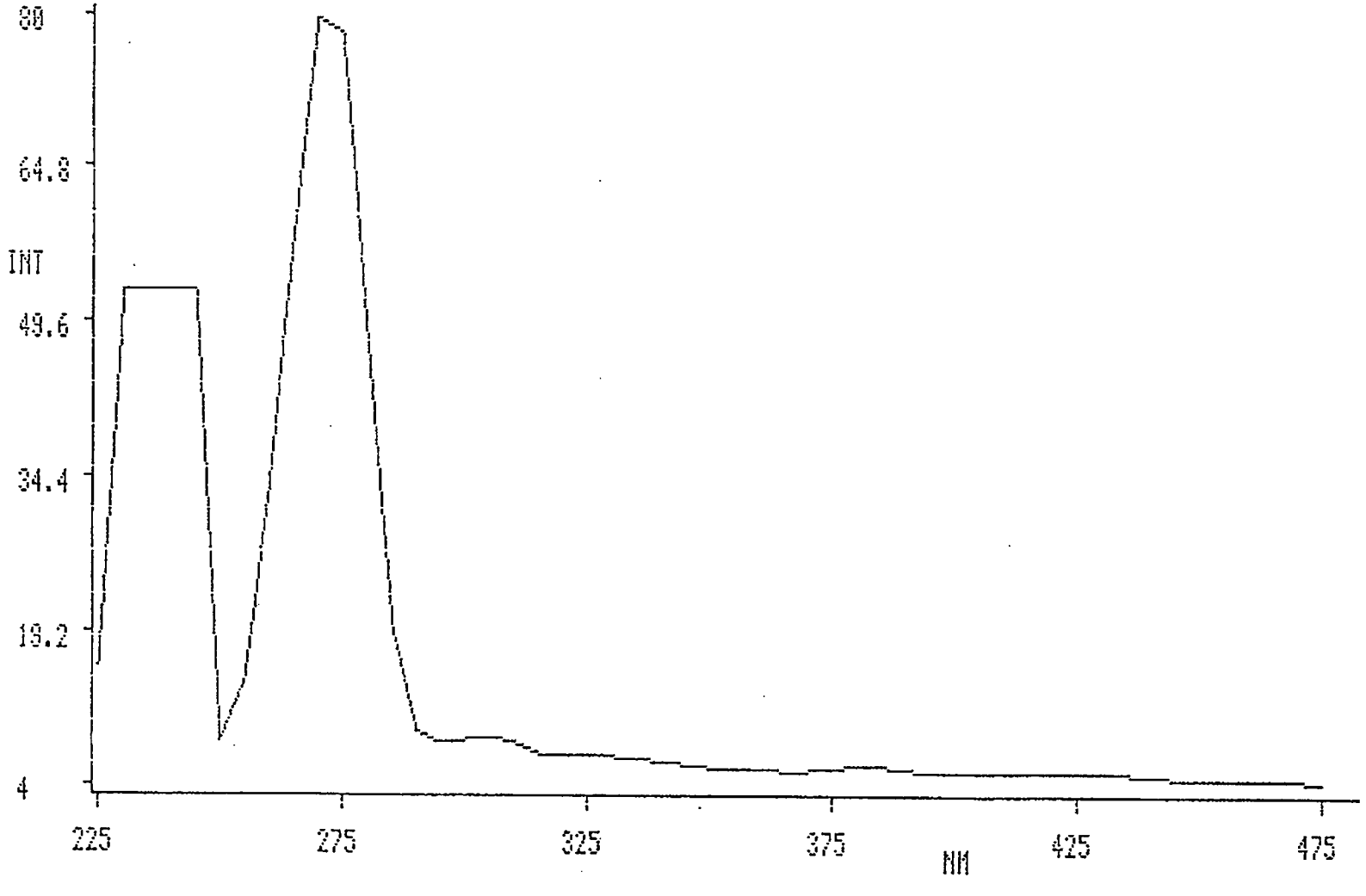


Specific Gravity 0.7660

Average Molecular Wt. 126

SYNCHRONOUS FLUORESCENCE

SAMPLE NO. F-185 500 PPM



ATX-93-0158

CONSCI

Arco Corporate Toxicology Dept.
515 South Flower St.
Los Angeles, California 90071

September 21, 1993

Attn: Francis Koschier

Invoice #: 101913
PO #: CS92-001

Certificate #: 30819018
Sample ID: F-250, Coker Naphtha
Date Received: August 19, 1993

CAS # 68513-02-0

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.7516	---	WMG	08/23/93
Refractive Index	D-1218	1.4242	---	RDP	08/26/93
Avg. Mol. Wt	GPSA	123.8	---	WMG	09/11/93
Sulfur (MC)	D-3120	5810	mg/Kg	MY	08/26/93
Total Oxygen	D-4815	< 0.01	wt.%	EB	09/11/93
Carbon	Calc.	86.26	wt.%	WMG	09/11/93
Hydrogen	Calc.	13.74	wt.%	WMG	09/11/93
Nitrogen	D-4629	2	mg/Kg	MS	08/31/93
Viscosity	D-445				
100 F		0.69	cst.	DGN	08/27/93
122 F		0.62	cst.	DGN	08/27/93
210 F		---	---	---	---
Pour Point	D-97	<-85	°F	DGN	08/27/93
Existent Gum	D-381				
Washed		8.8	mg/100ml	DGN	08/27/93
Unwashed		10.8	mg/100ml	DGN	08/27/93

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.1	mg/kg	GAB	09/07/93
Copper	220.1	< 0.5	mg/kg	GAB	09/07/93
Iron	236.1	0.5	mg/kg	GAB	09/08/93
Nickel	249.1	< 0.05	mg/kg	GAB	09/08/93
Sodium	273.1	< 0.03	mg/kg	GAB	09/08/93
Vanadium	286.1	< 0.5	mg/kg	GAB	09/08/93
Arsenic	206.3	< 0.001	mg/kg	GAB	09/08/93
Chromium	218.1	< 0.05	mg/kg	GAB	09/08/93

Arco Corporate Toxicology Dept.
Certificate #: 30819018
Sample ID: F-250, Coker Naphtha
Analysis Date: September 7, 1993
Analyst: MS

CERTIFICATE OF ANALYSIS

Component	Amt. Detected	Detection Limit
Acenaphthene	N.D.	0.1
Acenaphthylene	N.D.	0.1
Anthracene	N.D.	0.1
Benzo(a)anthracene	N.D.	0.1
Benzo(a)pyrene	N.D.	0.1
Benzo(a)fluoranthene	N.D.	0.1
Benzo(ghi)perylene	N.D.	0.1
Benzo(k)fluoranthene	N.D.	0.1
Chrysene	N.D.	0.1
Dibenzo(a,h)anthracene	N.D.	0.1
Fluoranthene	N.D.	0.1
Fluorene	N.D.	0.1
Indeno(1,2,3-cd)pyrene	N.D.	0.1
Naphthalene	14.0	0.1
Phenanthrene	N.D.	0.1
Pyrene	N.D.	0.1
2-Methylnaphthalene	1.2	0.1
1-Methylnaphthalene	N.D.	0.1

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
2,3-Dimethylbutane	0.01	0.01
2-Methylpentane	0.21	0.23
3-Methylpentane	0.18	0.19
n-Hexane	1.71	1.86
2,2-Dimethylpentane	0.01	0.01
Methylcyclopentane	0.58	0.56
2,4-Dimethylpentane	0.04	0.04
Benzene	0.22	0.18
Cyclohexane	0.29	0.27
2-Methylhexane	0.82	0.87
2,3-Dimethylpentane	2.81	2.90
1,1-Dimethylcyclopentane	0.04	0.04
3-Methylhexane	1.05	1.10
t-1,3-Dimethylcyclopentane	0.27	0.26
c-1,3-Dimethylcyclopentane	0.24	0.23
3-Ethylpentane	0.04	0.04
t-1,2-Dimethylcyclopentane	0.35	0.33
n-Heptane	5.35	5.62
c-1,2-Dimethylcyclopentane + Methylcyclohexane	1.23	1.15
2,2-Dimethylhexane + 113 TMCP	0.04	0.04
Ethylcyclopentane	0.71	0.67
2,5-Dimethylhexane	0.08	0.08
1,2,4-Trimethylcyclopentane	0.14	0.13
2,3,4-Trimethylpentane	0.10	0.10
2,3,3-Trimethylpentane	0.01	0.01
Toluene	2.23	1.85
2,3-Dimethylhexane	0.08	0.08
C8 Naphthene + C8 Paraffin	0.19	0.18
2-Methylheptane	2.05	2.11
4-Methylheptane	0.40	0.41
C8 Paraffin	0.03	0.03
3-Methylheptane	0.74	0.75
3-Ethylhexane + c-1,4-Dimethylcyclohexane	0.50	0.46
t-1,4-Dimethylcyclohexane	0.10	0.09
C8 Naphthene	0.09	0.09
C8 Naphthene	0.28	0.26

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
C8 Naphthene	0.24	0.23
C8 Naphthene	0.39	0.37
C8 Naphthene	0.03	0.03
t-1,2-Dimethylcyclohexane	0.18	0.17
n-Octane	5.02	5.13
C8 Naphthene	0.26	0.24
1,2,3-Trimethylcyclopentane	0.10	0.09
C9 Naphthene	0.16	0.15
C9 Paraffin	0.06	0.06
Isopropylcyclopentane	0.12	0.11
C9 Paraffin	0.39	0.39
c-1,2-Dimethylcyclohexane	1.00	0.90
1,3,5-Trimethylcyclohexane	0.55	0.51
C9 Naphthene	0.04	0.04
C9 Naphthene	0.04	0.04
C9 Naphthene	0.05	0.05
C9 Naphthene	0.09	0.08
C9 Naphthene	0.11	0.10
C9 Naphthene	0.07	0.06
C9 Naphthene	0.09	0.08
Ethylbenzene	0.79	0.66
C9 Naphthene	0.04	0.04
C9 Naphthene	0.01	0.01
m-Xylene	1.74	1.45
p-Xylene	0.63	0.53
C9 Paraffin	0.26	0.26
3,4-Dimethylheptane + C8 Dinaphthene	0.04	0.04
2-Methyloctane	0.54	0.54
4-Methyloctane	0.72	0.72
3-Ethylheptane	0.09	0.09
3-Methyloctane	1.16	1.16
o-Xylene	0.80	0.65
C9 Naphthene	0.07	0.06
C9 Naphthene	0.06	0.06
C9 Naphthene	0.07	0.06
C9 Naphthene	0.11	0.10
C9 Naphthene	0.34	0.32
Naphthene	0.33	0.31

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
Naphthene	0.10	0.09
C9 Naphthene	0.10	0.09
C9 Dinaphthene	0.13	0.12
n-Nonane	4.67	4.68
C9 Naphthene	0.09	0.08
C9 Naphthene	0.19	0.17
C9 Naphthene	0.06	0.06
C9 Naphthene	0.24	0.22
Isopropylbenzene	0.18	0.15
C9 Dinaphthene	0.11	0.10
C10 Paraffin	0.05	0.05
Naphthene	0.01	0.01
C10 Naphthene	0.02	0.02
C9 Naphthene	0.07	0.06
C10 Naphthene	0.07	0.06
C10 Naphthene	0.29	0.26
C10 Dinaphthene	0.40	0.36
C10 Naphthene	0.02	0.02
C10 Naphthene	0.04	0.04
C10 Paraffin	0.75	0.74
3,3-Dimethyloctane	0.04	0.04
C10 Paraffin	0.32	0.31
n-Propylbenzene	0.44	0.37
Naphthene	0.03	0.03
Naphthene	0.04	0.04
Naphthene	0.03	0.03
1-Methyl-3-ethylbenzene + C10 Paraffin	0.90	0.75
1-Methyl-4-ethylbenzene	0.47	0.39
2,3-Dimethyloctane	0.09	0.09
1,3,5-Trimethylbenzene	0.41	0.34
C10 Naphthene + C10 Paraffin	0.25	0.22
4-Methylnonane	0.67	0.66
2-Methylnonane	0.55	0.54
Naphthene	0.02	0.02
3-Ethyloctane	0.07	0.07
1-Methyl-2-ethylbenzene	0.49	0.40
C10 Dinaphthene	0.04	0.04

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
3-Methylnonane	0.36	0.35
1,2,4-Trimethylbenzene	1.04	0.85
C10 Naphthene	0.07	0.06
C10 Naphthene	0.03	0.03
C10 Naphthene	0.12	0.11
C10 Naphthene	0.24	0.22
C10 Naphthene	0.15	0.13
C10 Naphthene	0.08	0.07
C10 Naphthene	0.15	0.13
n-Decane	3.61	3.55
C10 Naphthene	0.09	0.08
1,2,3-Trimethylbenzene	0.65	0.52
Naphthene	0.26	0.23
Indan	0.22	0.16
C11 Paraffin	0.41	0.40
C11 Paraffin	0.04	0.04
C10 Naphthene	0.19	0.17
C10 Naphthene	0.25	0.22
C11 Paraffin	0.17	0.16
1,3-Diethylbenzene	0.14	0.12
1-Methyl-3-n-propylbenzene	0.22	0.18
C11 Paraffin	0.03	0.03
n-Butylbenzene	0.14	0.12
1,2-Diethylbenzene	0.15	0.12
1,3-Dimethyl-5-ethylbenzene + 1,4-Diethylbenzene	0.21	0.18
C11 Paraffin	0.14	0.13
C11 Paraffin	0.11	0.11
C11 Paraffin	0.14	0.13
Naphthene	0.12	0.11
C11 Paraffin	0.10	0.10
Naphthene	0.03	0.03
Naphthene	0.02	0.02
Naphthene	0.04	0.04
Naphthene	0.01	0.01
Naphthene	0.01	0.01
1,2-Dimethyl-3-ethylbenzene	0.12	0.10

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	L.V. %
n-Undecane	0.54	0.52
1,2,4,5-Tetramethylbenzene	0.12	0.10
1,2,3,5-Tetramethylbenzene	0.12	0.10
C11 & C12 Indans	0.15	0.11
C11 Aromatics	0.18	0.14
Total Olefins	36.57	39.17
Totals	100.00	100.00

Hydrocarbon Type Summary	Wt %	LV %
n-Paraffins	20.90	21.36
Isoparaffins	16.30	16.48
Naphthenes	13.56	12.55
Aromatics	12.67	10.45
Unknowns	0.00	0.00
Olefins	36.57	39.17
Totals	100.00	100.00

William M. Geiger

WMG/ar

ATX-93-0158

Certificate No.: 30819018
Description: F-250
Analysis Date: September 7, 1993
Analyst: PAR

CONSCI

	% Overhead	Deg. F
IBP	0.5	143
	2	154
	4	161
	6	176
	8	188
	10	195
	12	201
	14	205
	16	209
	18	212
	20	215
	22	217
	24	220
	26	228
	28	230
	30	233
	32	238
	34	241
	36	245
	38	249
	40	253
	42	257
	44	259
	46	262
	48	266
	50	269
	52	273
	54	279
	56	283
	58	286
	60	290
	62	293
	64	298
	66	303
	68	307
	70	309
	72	312
	74	316
	76	321
	78	324
	80	328
	82	333
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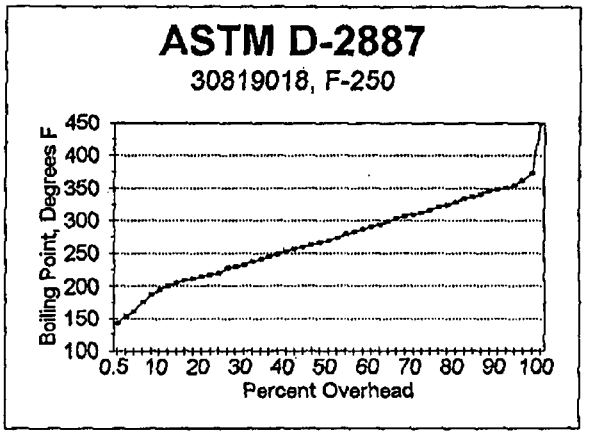
	86	341
	88	345
	90	348
	92	350
	94	354
	96	362
	98	373
FBP	100	448



Specific Gravity 0.7516

Avg. Mol. Wt. 123.8

CONSOLIDATED SCIENCES, INCORPORATED 1416 SOUTHMORE PASADENA, TEXAS 77502 (713) 920-1696 FAX (713) 920-1648

ATX-92-0128

F-186

ATX-92-0128

CONSCI

ARCO
Environment, Health & Safety
515 South Flower Street
Los Angeles, California 90071

December 31, 1992

Attn: Francis J. Koschier, Ph.D.

Invoice #: 100303

Certificate #: 21207012
Sample ID: F-186
Date Received: December 7, 1992

No CAS # Provided

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.6659	---	ECB	12/08/92
Refractive Index	D-1218	1.3761	---	RDP	12/14/92
Avg. Mol. Wt	GPSA	86	---	WMG	12/24/92
Sulfur (MC)	D-3120	4	ppm/wt	TES	12/15/92
Total Oxygen	Neut. Act.	< 0.01	wt.%	WDJ	12/17/92
Carbon	Calc.	84.02	wt.%	WMG	12/24/92
Hydrogen	Calc.	15.98	wt.%	WMG	12/24/92
Nitrogen	D-4629	2	ppm/wt	JWT	12/17/92
Viscosity	D-445				
100 F		0.43	cst.	RDP	12/16/92
122 F		0.39	cst.	RDP	12/16/92
210 F		NA	NA	NA	NA
Pour Point	D-97	<-76	°F	DCM	12/18/92
Existent Gum	D-381				
Washed		0.2	mg/100ml	DCM	12/16/92
Unwashed		0.2	mg/100ml	DCM	12/16/92

10001892 ATX-920128

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.2	mg/kg	GAB	12/21/92
Copper	220.1	< 0.1	mg/kg	GAB	12/21/92
Iron	236.1	< 0.1	mg/kg	GAB	12/21/92
Nickel	249.1	< 0.1	mg/kg	GAB	12/21/92
Sodium	273.1	19.0	mg/kg	GAB	12/21/92
Vanadium	286.1	< 1.0	mg/kg	GAB	12/21/92
Arsenic	206.3	< 0.002	mg/kg	GAB	12/21/92
Chromium	218.1	< 0.1	mg/kg	GAB	12/21/92

CERTIFICATE OF ANALYSIS-METHOD 8270

PARAMETER	RESULTS	UNITS	ANALYST	DATE
POLYNUCLEAR AROMATICS:				
Naphthalene	< 2	mg/kg	DMK	12/22/92
2-Methylnaphthalene	< 2	mg/kg	DMK	12/22/92
1-Methylnaphthalene	< 2	mg/kg	DMK	12/22/92
Acenaphthylene	< 2	mg/kg	DMK	12/22/92
Acenaphthene	< 2	mg/kg	DMK	12/22/92
Fluorene	< 2	mg/kg	DMK	12/22/92
Phenanthrene	< 2	mg/kg	DMK	12/22/92
Anthracene	< 2	mg/kg	DMK	12/22/92
Fluoranthene	< 2	mg/kg	DMK	12/22/92
Pyrene	< 2	mg/kg	DMK	12/22/92
Benzo(a)anthracene	< 2	mg/kg	DMK	12/22/92
Chrysene	< 2	mg/kg	DMK	12/22/92
Benzo(b)fluoranthene	< 2	mg/kg	DMK	12/22/92
Benzo(k)fluoranthene	< 2	mg/kg	DMK	12/22/92
Benzo(a)pyrene	< 2	mg/kg	DMK	12/22/92
Dibenzo(a,h)anthracene	< 2	mg/kg	DMK	12/22/92
Benzo(g,h,i)perylene	< 2	mg/kg	DMK	12/22/92
Ideno(1,2,3-cd)pyrene	< 2	mg/kg	DMK	12/22/92

ARCO
Certificate #: 21207012
Sample ID: F-186

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
Isopentane	0.01	0.01
n-Pentane	5.51	5.86
2,2-Dimethylbutane	0.07	0.07
Cyclopentane	0.49	0.44
2,3-Dimethylbutane	0.26	0.26
2-Methylpentane	2.04	2.08
3-Methylpentane	1.18	1.18
n-Hexane	78.22	79.10
2,2-Dimethylpentane	0.03	0.03
Methylcyclopentane	1.57	1.40
2,4-Dimethylpentane	0.07	0.07
2,2,3-Trimethylbutane	0.01	0.01
Benzene	2.51	1.91
3,3-Dimethylpentane	0.01	0.01
Cyclohexane	0.93	0.80
2-Methylhexane	0.23	0.23
2,3-Dimethylpentane	0.09	0.09
1,1-Dimethylcyclopentane	0.05	0.04
3-Methylhexane	0.24	0.23
t-1,3-Dimethylcyclopentane	0.10	0.09
c-1,3-Dimethylcyclopentane	0.11	0.10
t-1,2-Dimethylcyclopentane	0.17	0.15
n-Heptane	5.39	5.26
c-1,2-Dimethylcyclopentane + Methylcyclohexane	0.22	0.19
Ethylcyclopentane	0.02	0.02
Toluene	0.44	0.34
Total Olefins	0.03	0.03
Totals	100.00	100.00

ARCO
Certificate #: 21207012
Sample ID: F-186

Hydrocarbon Type Summary		Wt. %	LV %
n-Paraffins		89.12	90.22
Isoparaffins		4.24	4.27
Naphthenes		3.66	3.23
Aromatics		2.95	2.25
Unknowns		0.00	0.00
Olefins		0.03	0.03
	Totals	100.00	100.00

Michael A. Sommer II, Ph.D.

MAS/ar

Certificate No.: 21207012
Description: F-186
Analysis Date: December 12, 1992
Analyst: PAR

CONSCI

	% Overhead	Deg. F
IBP	0.5	96
	2	97
	4	99
	6	135
	8	144
	10	153
	12	154
	14	155
	16	156
	18	156
	20	157
	22	157
	24	158
	26	159
	28	159
	30	160
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	64	170
	66	170
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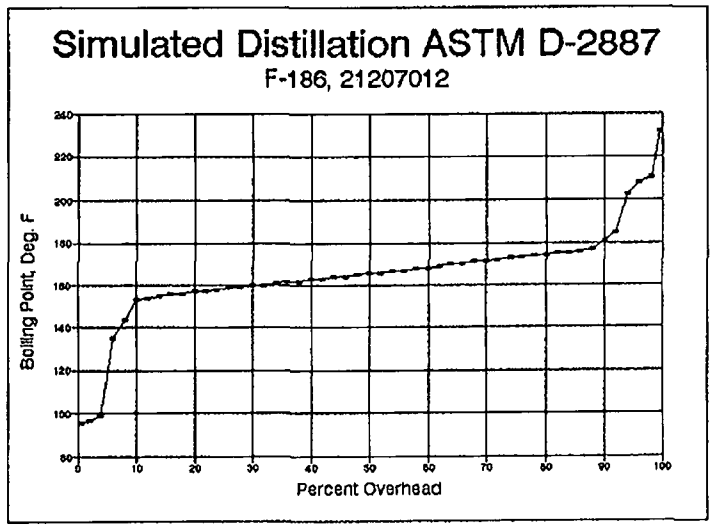
	72	172
	74	173
	76	173
	78	174
	80	174
	82	175
	84	175
	86	176
	88	177
	90	181
	92	185
	94	203
	96	208
	98	210
FBP	99.5	232

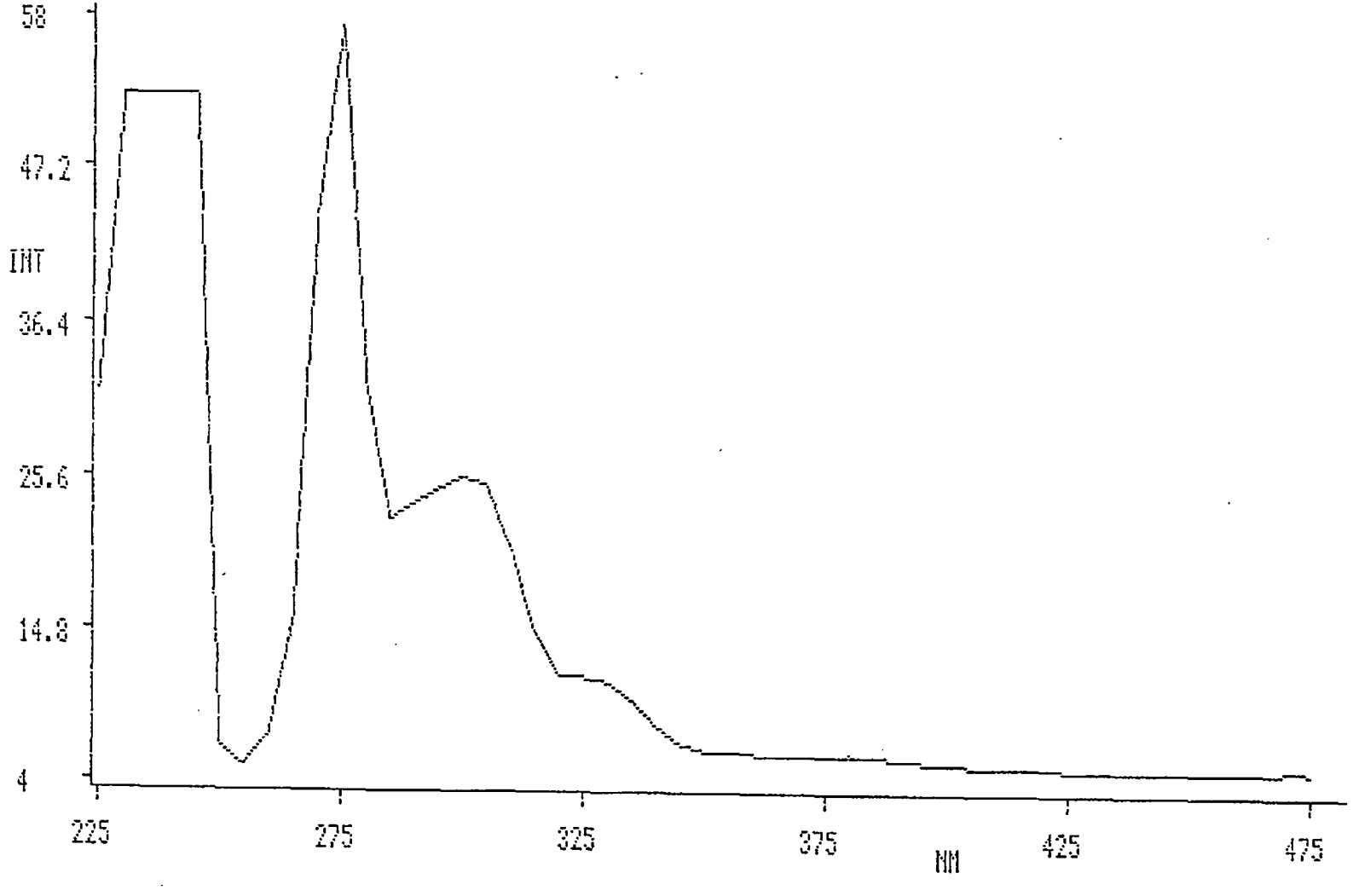


Specific Gravity 0.6559

Average Molecular Wt. 86

SYNCHRONOUS FLUORESCENCE

SAMPLE NO. F-186 500,000 PPM



ATX-92-0137 F-187

ATX-92-0137

CONSCI

ARCO
Environment, Health & Safety
515 South Flower Street
Los Angeles, California 90071

December 31, 1992

Attn: Francis J. Koschier, Ph.D.

Invoice #: 100303

Certificate #: 21207021
Sample ID: F-187
Date Received: December 7, 1992

10001901 ATX-920137

CERTIFICATE OF ANALYSIS

NO CAS# Provided

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
Specific Gravity	D-1298	0.7079	---	ECB	12/08/92
Refractive Index	D-1218	1.3963	---	RDP	12/14/92
Avg. Mol. Wt	GPSA	101	---	WMG	12/13/92
Sulfur (MC)	D-3120	2	ppm/wt.	TES	12/16/92
Total Oxygen	Neut. Act.	< 0.01	wt.%	WDJ	12/17/92
Carbon	Calc.	85.37	wt.%	WMG	12/28/92
Hydrogen	Calc.	14.63	wt.%	WMG	12/28/92
Nitrogen	D-4629	1	ppm/wt.	JWT	12/18/92
Viscosity	D-445				
100 F		0.49	cst.	TES	12/21/92
122 F		0.45	cst.	TES	12/21/92
210 F		NA	NA	NA	NA
Pour Point	D-97	< -76	°F	RDP	12/28/92
Existent Gum	D-381				
Washed		0.2	mg/100ml	DCM	12/16/92
Unwashed		0.4	mg/100ml	DCM	12/16/92

ARCO
Certificate #: 21207021
Sample ID: F-187

CERTIFICATE OF ANALYSIS

PARAMETER	METHOD	RESULTS	UNITS	ANALYST	DATE
METALS:					
Lead	239.1	< 0.2	mg/kg	GAB	12/21/92
Copper	220.1	< 0.1	mg/kg	GAB	12/21/92
Iron	236.1	0.22	mg/kg	GAB	12/21/92
Nickel	249.1	< 0.1	mg/kg	GAB	12/21/92
Sodium	273.1	19.6	mg/kg	GAB	12/21/92
Vanadium	286.1	< 0.1	mg/kg	GAB	12/21/92
Arsenic	206.3	< 0.002	mg/kg	GAB	12/21/92
Chromium	218.1	< 0.1	mg/kg	GAB	12/21/92

ARCO
Certificate #: 21207021
Sample ID: F-187

CERTIFICATE OF ANALYSIS-METHOD 8270

PARAMETER	RESULTS	UNITS	ANALYST	DATE
POLYNUCLEAR AROMATICS:				
Naphthalene	< 1	mg/kg	DMK	12/13/92
2-Methylnaphthalene	< 1	mg/kg	DMK	12/13/92
1-Methylnaphthalene	< 1	mg/kg	DMK	12/13/92
Acenaphthylene	< 1	mg/kg	DMK	12/13/92
Acenaphthene	< 1	mg/kg	DMK	12/13/92
Fluorene	< 1	mg/kg	DMK	12/13/92
Phenanthrene	< 1	mg/kg	DMK	12/13/92
Anthracene	< 1	mg/kg	DMK	12/13/92
Fluoranthene	< 1	mg/kg	DMK	12/13/92
Pyrene	< 1	mg/kg	DMK	12/13/92
Benzo(a)anthracene	< 1	mg/kg	DMK	12/13/92
Chrysene	< 1	mg/kg	DMK	12/13/92
Benzo(b)fluoranthene	< 1	mg/kg	DMK	12/13/92
Benzo(k)fluoranthene	< 1	mg/kg	DMK	12/13/92
Benzo(a)pyrene	< 1	mg/kg	DMK	12/13/92
Dibenzo(a,h)anthracene	< 1	mg/kg	DMK	12/13/92
Benzo(g,h,i)perylene	< 1	mg/kg	DMK	12/13/92
Ideno(1,2,3-cd)pyrene	< 1	mg/kg	DMK	12/13/92

ARCO
Certificate #: 21207021
Sample ID: F-187
Date Received: December 7, 1992

CAPILLARY GAS CHROMATOGRAPHY ANALYSIS

Component Name	Wt. %	LV %
Isopentane	0.02	0.02
n-Pentane	1.19	1.35
2,2-Dimethylbutane	0.61	0.67
Cyclopentane	4.18	4.00
2-Methylpentane	20.35	22.22
3-Methylpentane	12.22	13.12
n-Hexane	10.42	11.27
2,2-Dimethylpentane	0.30	0.32
Methylcyclopentane	17.54	16.71
2,4-Dimethylpentane	0.66	0.70
2,2,3-Trimethylbutane	0.06	0.06
Benzene	9.56	7.76
3,3-Dimethylpentane	0.10	0.10
Cyclohexane	10.52	9.64
2-Methylhexane	2.16	2.27
2,3-Dimethylpentane	0.84	0.86
1,1-Dimethylcyclopentane	0.50	0.47
3-Methylhexane	2.15	2.23
t-1,3-Dimethylcyclopentane	0.93	0.89
c-1,3-Dimethylcyclopentane	0.95	0.91
t-1,2-Dimethylcyclopentane	1.53	1.45
n-Heptane	0.59	0.62
c-1,2-Dimethylcyclopentane + Methylcyclohexane	1.74	1.61
2,2-Dimethylhexane + 113 TMCP	0.03	0.03
Ethylcyclopentane	0.11	0.10
2,2,3-Trimethylpentane + 2,4-Dimethylpentane	0.01	0.01
1,2,4-Trimethylcyclopentane	0.01	0.01
2,3,4-Trimethylpentane	0.01	0.01
Toluene	0.70	0.58
Total Olefins	0.01	0.01
Totals	100.00	100.00

ARCO
Certificate #: 21207021
Sample ID: F-187
Date Received: December 7, 1992

Hydrocarbon Type Summary		Wt. %	LV %
n-Paraffins		12.20	13.24
Isoparaffins		39.49	42.59
Naphthenes		38.04	35.82
Aromatics		10.26	8.34
Unknowns		0.00	0.00
Olefins		0.01	0.01
	Totals	100.00	100.00

Michael A. Sommer II, Ph.D.

MAS/ar

Certificate No.: 21207021
Description: F-187
Analysis Date: December 12, 1992
Analyst: PAR

CONSCI

	% Overhead	Deg. F
IBP	0.5	114
	2	137
	4	139
	6	140
	8	141
	10	141
	12	142
	14	142
	16	143
	18	144
	20	144
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	80	187
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	92	196
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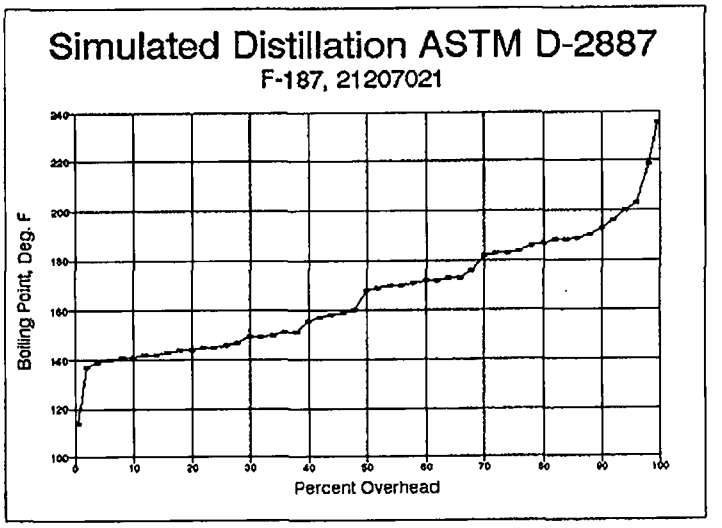
	96	203
	98	219
FBP	99.5	236



Specific Gravity 0.7079

Average Molecular Wt. 101

SYNCHRONOUS FLUORESCENCE

SAMPLE NO. F-187 5000 PPM