TABLE 115

Deposition from Jet A Spiked with Selected Organosulfur Compounds[1]

Compound added[2]	μg Deposit[3]
n-Butyl sulfide	294 ± 36
n-Pentyl sulfide	280 ± 29
n-Butyl disulfide	270 ± 26
n-Pentyl disulfide	248 ± 13
iso-Pentyl disulfide	232 ± 23
1-Butanethiol	428 ± 22
1-Pentanethiol	393 ± 33
Benzenethiol	361 ± 46
p-Toluenethiol	372 ± 39
1-Naphthalenethiol	343 ± 29
Toluene-3,4 dithiol	414 ± 42
Dibenzothiophene	404 ± 52
Control	322 ± 33

[1] Aged at 135 °C (275 °F) for 168 hours
[2] 10 μg sulfur/ml jet A fuel
[3] On microscope cover slip.

Taken from Reference No. 50

TABLE 116

Dependence of Deposit Formation Upon Sulfur Concentration in Jet A Fuel [1]

Compound added	Concentration (μg sulfur/ml fuel)	μg Deposit[2]
Benzenethiol	10	84 ± 19
Benzenethiol	100	104 ± 11
Benzenethiol	500	172 ± 15
Benzenethiol	1000	294 ± 21
n-Butyl sulfide	10	68 ± 3
n-Butyl sulfide	100	62 ± 9
n-Butyl sulfide	500	48 ± 5
n-Butyl sulfide	1000	41 ± 6
Control	--	71 ± 10

[1] Aged at 121 °C (249.8 °F) for 168 hours
[2] On microscope cover slip

Taken from Reference No. 50

TABLE 117
Effects of Sulfur Compounds on Deposition From Jet A[1]

Compound Added	ug deposit[2]		
	121 °C	130 °C	135 °C
Control (No spike)	71±10	191±23	322±33
Toluene-3,4 dithiol	110±10	249±29	414±42
Dibenzothiophene	104±13	243±23	404±52
1-Pentanethiol	94±7	233±29	393±33
p-Toluenethiol	87±13	--	372±39
Benzenethiol	34±19	214±26	361±46
1-Naphthalenethiol	78±7	--	343±29
n-Butyl sulfide	68±3	172±26	294±36
n-Pentyl sulfide	62±13	159±16	280±29
n-Butyl disulfide	55±6	156±13	270±26
n-Pentyl disulfide	49±3	133±26	248±13
iso-Pentyl disulfide	42±10	123±16	232±23

[1] 10 ug Sulfur/ml fuel added, aged 168 hours at indicated temperature)
[2]On Microscope Cover Slip

Taken from Reference No. 50

TABLE 118
Effects of Reactive Vinyl Olefins on Sediment Formation With DMP In Jet Fuel[1]

	Sediment (mg/100 cc) After 28 Days[3]		
Olefin[2]	Insoluble	Adherent	Total
None	6.6	133.9	140.5
4-Vinyl-1-cyclohexene	24.5	92.5	117.0
Vinylcyclohexane	5.7	132.6	138.3
4-Vinylpyridine	206.5	32.7	239.2
2-Vinylpyridine	154.5	89.3	243.8

[1] DMP present at 750 ppm N level in all cases; storage at 43.3 °C (110°F).
[2] 2 Vol. % added
[3] Average of 3 replicates.

Taken from Reference No. 39

TABLE 119

Particle Counts on Stored Oils During Aging

Fuel Oil Type[1]	STORAGE Time/Temperature	SLUDGE PARTICLE COUNT, Particles/0.05 cubic mm			
		20-50 Microns	5-20 Microns	1-5 Microns	0.1-1 Microns
A	3 Weeks/Room Temperature	0	0	0	150
	10 Weeks/Room Temperature	0	5	100	300
B	3 Weeks/Room Temperature	0	0	0	200
	10 Weeks/Room Temperature	0	4	40	100
C	6 Weeks/Room Temperature	0	0	0	200
	11 Weeks/Room Temperature	0	3	20	150
D	8 Weeks/Room Temperature	0	1	30	300
	14 Weeks/Room Temperature	0	4	150	0
E	9 Weeks/Room Temperature	1	50	50	0
	14 Weeks/Room Temperature	1	40	250	0
F	0 Weeks/Ambient (Aver. 100 F.)	0	0	0	150
	4 Weeks/Ambient (Aver. 100 F.)	1	2	50	1800

[1]A: 70 percent light cat cycle, 30 percent thermally cracked (from mixed Mid-Continent and Gulf Coast crudes), no plant treatment.
B: Same as "A" but cycle oil caustic-treated and thermally-cracked oil acid-treated prior to blending.
C: 75 percent light cat cycle, 18.7 percent sweet blend oil, 6.3 percent West Texas blend (from mixed Mid-Continent and Gulf Coast crudes).
D: 90 percent cat cracked, 10 percent straight-run naphtha (from Mid-Continent crude).
E: 75 percent cat cracked, 25 percent kerosine (from Mid-Continent crude).
F: Blend of straight-run and cat cracked oils (from Mid-Continent crude).

Taken from Reference No. 118

TABLE 120
Storage Time Vs. Temperature For Fuel Oil Blends

	Storage Time, Hours to 2 mg/100 ml Insolubles				Ratio $\frac{S_T{}^2}{S_{212\,°F}{}^3}$		
	212 °F	180 °F	150 °F	110 °F	180 °F	150 °F	110 °F
Fuel Oil Blends[1]							
D	9.0	35	156	1275	3.9	17.3	142
E	11.0	40	160	1180	3.6	14.6	107
H	7.0	25	112	900	3.6	16.0	129
N	15.0	55	245		3.7	16.3	
S	17.0	65	285		3.8	16.7	
W	9.5	35	138		3.7	14.5	
4B	5.0	18		744	3.6		149
Fuel Oil Blends With Additives							
F	12.0	45	205	1875	3.7	17.1	156
G	60.0	192	925		3.2	15.4	
M	18.0	69	285		3.8	15.8	
O	32.0	128	518		4.0	16.2	
P	15.0	56	258		3.7	17.2	
R	41.0	138	615		3.4	15.0	
T	53.0	168	810		3.2	15.3	
X	13.5	51	210		3.7	15.6	
Z	36.5	133	567		3.6	15.5	
02	13.0	48		1728	3.7		133
		Avg. Ratio $\frac{S_T}{S_{212\,°F}}$			3.6	15.9	136

[1]No. 2 Fuel Oils

[2]S_T = Storage time at temperature T to form 2 mg/100 ml insolubles

[3]$S_{212\,°F}$ = Storage time at 212 °F to form 2 mg/100 ml insolubles

Taken from Reference No. 75

TABLE 121

Storage Time Vs. Temperature For Eight Fuel Oils

Oil No.[1]	Source	Storage Time, Hours to 2 mg/100 ml. Insolubles			Ratio $\frac{S_T[2]}{S_{212\,°F}[3]}$	
		212 °F	180 °F	150 °F	180 °F	150 °F
1	East Coast	1.8	7	29	3.9	16.1
2	East Coast	9.0	34	142	3.8	15.8
3	East Coast	16.0	59	258	3.7	16.1
4	East Coast	16.0	58	220	3.6	13.8
5	Mid West	6.0	19	110	3.2	18.3
6	Mid West	21.0	68	310	3.2	14.8
7	Mid West	41.0	138	650	3.5	15.9
8	Mid West	13.0	50	195	3.8	15.0
		Avg. Ratio $\frac{S_T}{S_{212\,°F}}$			3.6	15.7

[1]No. 2 Fuel Oils

[2]S_T = Storage time at temperature T to form 2 mg/100 ml insolubles

[3]$S_{212\,°F}$ = Storage time at 212 °F to form 2 mg/100 ml insolubles

Taken from Reference No. 75

TABLE 122

Effect of Aromatic Thiols and Disulfides on Stability of Catalytically Cracked Fuel Oil from Middle East Crude[1,2]

Sample	Sediment, Mg./Liter
Blank A (0.017% S as —SH)	200
A' (A washed with 5% NaOH)	85
A' plus benzenethiol	
0.52 g./liter	164
1.05 g./leter	269
263 g./liter	445
A' plus xylenethiols	
0.66 g./liter	210
1.32 g./liter	366
3.29 g./liter	519
A' plus diphenyldisulfide, 0.52 g./liter	83
Blank B	166
B' (B washed with 43% KOH)	35
With KOH extract reblended	191
Blank C	190
C' (C washed with 50% KOH)	29
Plus dimesityl disulfide, 0.42 g./liter	35

[1] All experiments were made on freshly cracked refinery samples in the absence of air. These oils were variable in quality from day to day, which made it necessary to include blanks with each treatment.

[2] 12-week stability at 43.3 °C (110 °F).

TABLE 123

Effect on Stability of Pyrrole Removal and Replacement with Other Nitrogen Compounds in Catalytically Cracked Fuel Oil from Middle East Crude[1]

Sample	Sediment Mg./Liter
Blank A	287
A' (A washed with 43% KOH)	48
A" (A' treated with formalin in 5% H_2SO_4)	8
Plus KOH extract from A	30
Blank B	180
B' (B washed with 50% KOH, treated with formalin-5% H_2SO_4, and reblended with KOH extract)	55
B' plus nitrogen compounds (0.01% N)	
Indole[2]	241
Pyridine[2]	56
2-Picoline[2]	39
Quinoline[2]	85
Quinaldine[2]	62

[1] 12-week stability at 43.3 °C (110 °F).

[2] Eastman Kodak Co.

TABLE 124

Stability Evaluation of Fuel Oils in a Modified Air Oxidation Procedure at 82.2°C (180 °F)

Sample No.[1]	Hrs. of Oxidation	Optical Density			Insolubles mg/100 ml	
		Before Filtration	After Filtration	Diff.	By Filtration, (Grav.)	Cal. from Optical Density Diff.
A	0	0.913	0.895	0.018	0.3	0.5
	12	1.322	1.211	0.111	1.2	1.8
	24	1.737	1.559	0.178	2.1	2.8
	32	2.080	1.901	0.179	2.7	2.8
	48	2.707	2.397	0.310	6.6	4.8
B	0	0.233	0.207	0.016	0.5	0.4
	24	0.737	0.602	0.135	1.0	2.2
	48	0.737	0.638	0.099	1.2	1.7
	72	1.558	1.364	0.194	2.7	3.0
	80	2.332	2.066	0.266	3.7	4.1
C	0	0.149	0.137	0.012	0.4	0.4
	96	0.538	0.509	0.029	0.7	0.7
	168	0.767	0.585	0.182	2.7	2.9
	216	0.954	0.699	0.255	3.3	3.9

[1] Commercial Fuel Oils

Taken from Reference No. 5

TABLE 125

Data From 43.3 °C (110 °F) Storage of 34 Petroleum Distillate Fuels

Fuel description	Light transmission, percent weeks storage					Insoluble gum, mg. per 100 ml. weeks storage					Soluble gum, mg. per 100 ml. weeks storage		
	0	6	13	26	39	0	6	13	26	39	0	13	39
Straightrun													
W. Mid-Continent	99.5	98.9	98.8	96.0	93.9	0.1	0.2	0.2	0.5	0.5	1.3	1.6	2.4
E. Mid-Continent	87.1	80.5	76.5	72.2	63.9	.7	.7	.8	2.0	2.0	3.4	6.0	6.8
Gulf Coast	98.8	98.7	95.8	97.8	89.3	.4	.7	.3	.3	.3	nil	2.6	2.4
W. Texas	95.4	93.2	92.5	86.2	84.1	.5	.3	.4	.8	.4	1.7	3.2	3.4
California (1)	38.4	20.5	17.9	15.5	10.5	.9	.6	.7	1.3	1.8	6.9	14.6	28.2
California (2)	34.6	17.4	13.3	11.6	7.7	1.0	.8	1.1	1.1	1.6	6.6	18.0	29.8
Rocky Mountain	98.0	97.7	97.6	97.3	91.7	.3	.4	.5	.4	.9	1.0	2.4	2.8
Scurry County, Texas	99.5	97.9	90.0	85.9	87.7	.4	.9	1.3	1.9	6.0	nil	.6	3.4
Middle East	99.3	99.4	99.2	87.3	92.1	.2	.4	.7	.5	.8	.6	.4	1.2
Venezuelan	87.2	67.6	58.7	52.6	41.7	.5	.2	.6	3.1	1.4	1.8	2.8	9.4
Mexican (1)	45.9	60.9	66.5	50.0	39.6	.7	.7	.8	.5	.6	10.9	13.0	17.4
Mexican (2)	82.1	90.1	89.3	90.1	77.8	.5	.5	.5	.4	.1	5.5	4.0	5.4
Canadian	98.9	91.0	84.5	79.6	69.8	.9	.6	.5	.7	.3	1.6	1.4	2.8
Thermally cracked:													
W. Mid-Continent	85.5	21.1	22.5	23.8	23.6	.2	.4	.7	1.0	1.3	2.9	17.0	32.6
E. Mid-Continent	63.0	24.4	19.8	18.0	15.5	.3	.7	1.4	1.5	2.4	1.4	6.6	18.6
Gulf Coast	62.6	31.3	38.3	48.8	48.4	.3	1.1	2.6	14.0	51.3	1.8	31.2	259.2
W. Texas	43.2	35.0	32.4	29.9	31.8	.3	5.5	10.5	24.0	48.1	16.2	112.6	326.0
California(1)	25.2	<3	<3	<3	<3	.3	10.8	17.1	29.4	37.7	1.9	126.0	167.2
California (2)	<3	<3	<3	<3	<3	.7	28.3	49.3	93.3	127.7	19.4	414.0	597.8
Rocky Mountain	71.3	16.7	10.3	12.4	10.8	.1	.7	1.1	2.2	3.2	2.9	19.6	49.4
Canadian	59.3	3.0	6.4	15.5	6.5	.4	1.5	5.3	8.5	9.6	3.3	23.8	41.4
Mexican	81.8	74.9	72.3	65.5	58.0	.4	1.9	4.3	6.9	10.3	4.1	12.8	42.6
Catalytically cracked:													
W. Mid-Continent (1)	85.6	35.1	27.7	22.2	16.0	.2	1.2	2.7	5.4	6.1	1.6	10.8	26.8
W. Mid-Continent (2)	96.7	36.1	34.0	32.1	27.3	.1	2.7	4.1	6.2	5.8	1.6	17.6	18.0
E. Mid-Continent	93.4	85.6	68.8	57.5	49.6	.2	1.1	3.5	5.8	7.5	3.3	10.6	16.6
Gulf Coast	97.6	95.0	85.4	66.2	53.6	.1	.3	.9	2.3	1.8	nil	3.6	9.6
W. Texas	93.4	66.3	44.6	28.6	23.1	.5	1.0	2.1	5.0	7.0	2.5	21.4	44.4
California (1)	65.9	18.6	9.7	4.6	<3	.7	1.1	1.6	2.7	2.1	10.6	48.0	74.8
California (2)	42.9	3.5	.9	<3	<3	1.0	2.3	4.2	7.1	9.6	6.5	53.4	97.4
Rocky Mountain	92.0	42.5	14.9	11.3	7.9	.1	1.7	13.2	17.1	18.6	1.0	46.2	68.0
Scurry County, Texas	83.9	28.2	18.7	17.8	4.5	.2	3.1	8.2	11.8	15.6	5.5	30.2	35.8
Middle East	94.2	37.1	32.9	44.1	26.6	.1	7.6	12.1	17.4	18.1	2.3	13.2	26.4
Venezuelan	80.8	12.5	6.2	1.7	<3	.5	3.7	10.4	16.6	15.7	3.3	74.0	81.0
Canadian	48.6	18.7	11.5	9.1	4.0	3.3	1.8	3.8	7.7	7.4	7.9	39.4	61.4

Taken from Reference No. 103

TABLE 126

Comparison of One-Day Iron Stability Tests With Long Time Laboratory Storage Tests

Oil Composition	Drum Storage[1] Sediment mg/Liter	Bottle Storage[1] Sediment mg/Liter	Bottle Storage[1] Lacquer mg/Liter	Bottle Storage[1] Total Sediment Plus Lacquer mg/Liter	Total Sulfur, %	Mercaptan Sulfur, mg./100 ml	One Day Iron Stability Test[2], Sediment mg./100 ml
Untreated No. 2 Fuel Oil[3]	27.1	8.1	19.0	27.1	0.5	5.0	31.5
Caustic Treated No. 2 Fuel Oil[3]	11.4	10.2	6.7	16.9	0.5	5.0	23.3
Caustic Treated No. 2 Fuel Oil[3] + Inhibitor	4.0	2.1	1.8	3.9	0.5	5.0	2.0
Acid Treated No. 2 Fuel Oil[3]	1.8	2.0	0.8	2.8	0.45	2.0	3.0
Hydrogenated No. 2 Fuel Oil[3]	2.0	1.1	0.5	1.6	0.1	< 0.1	1.5
Untreated Cat. Cracked Fuel Oil	58.4	42.1	27.6	69.7	0.9	5	102.5
Caustic Treated Cat. Cracked Fuel Oil	20.6	17.6	14.1	31.7	0.9	2	31.1
Acid Treated Cat. Cracked Fuel Oil	6.2	4.2	1.3	5.5	0.8	0.2	5.0
Hydrogenated Cat. Cracked Fuel Oil	4.1	2.1	0.2	2.3	0.1	< 0.1	3.8
High Sulfur Straight Run Oil	32.2	6.8	24.8	31.6	0.55	80	60.0
Clay Desulfurized High Sulfur Fuel Oil	5.0	1.5	1.6	3.1	0.4	2	4.5
Caustic Treated Blend of 35% Cat. Cracked, 65% St. Run Oil A	20.0	12.5	8.9	21.4	0.6	5	19.2
Caustic Treated Blend of 35% Cat. Cracked, 65% St. Run Oil B	10.5	7.2	5.1	12.3	0.4	4	10.1
Caustic Treated Blend of 35% Cat. Cracked, 65% St. Run Oil C	5.2	5.0	1.8	6.8	0.5	6	5.6

[1]Stored six months at 29.4 °C (85 °F)
[2]Stored in sealed glass bottle containing iron strips for 24 hours at 100 °C (212 °F)
[3]Blend of Catalytically Cracked and Straight Run Oils.

Taken from Reference No. 45

Table 127

Ambient Storage of Catalytic Petroleum Distillates

Storage Time Days	Sample A			Sample B		
	Aromatic Thiols mg.S/100 ml.	Aromatic Disulfides mg. S/100 ml.	Peroxides-PPM Active Oxygen	Aromatic Thiols mg. S/100 ml.	Aromatic Disulfides mg. S/100 ml.	Peroxides-PPM Active Oxygen
0	3.3	0.1	0.4	2.2	0.1	1.0
49	2.0	0.8	8.0	1.0	0.7	1.0
99	0.6	1.6	2.0	0.2	1.0	3.2
133	---	---	1.0	---	---	1.6

Taken from Reference No. 95

TABLE 128

Effect of Thiols on the Stability of a Raw Blend[1] of Catalytically Cracked and Straight Run Distillates at 100 °C (212 °F).[2]

Sample	Thiol Added	Concentration Thiol Added mgs/100 ml.	Sediment mg./l.	ASTM Color After Test
1	None	0.000	14.4	2
2	p-toluenethiol	0.77	11.7	2 1/4
3	p-toluenethiol	6.0	84.5	3 1/4
4	p-toluenethiol	7.7	95.4	3
5	p-toluenethiol	40.0	283	6
6	1-pentanethiol	6.0	17.0	2
7	1-pentanethiol	40.0	12.5	2
8	α - toluenethiol	6.0	10.5	1 3/4+
9	α - toluenethiol	40.0	8.2	1 3/4+
10	tert-nonylthiol	6.0	15.2	2
11	tert-nonylthiol	37.0	23.6	2 1/4+
12	p-toluenethiol 1-pentanethiol	6.0 40.0	53.0	2 1/2
13	p-toluenethiol α - toluenethiol	6.0 40.0	50.0	2 1/4+
14	p-toluenethiol t-nonylthiol	6.0 37.0	48.5	2 3/4+

[1]35% Catalytic Distillate - 65% Straight Run Distillate
[2]24 Hours at 100 °C (212 °F) in an atmosphere of oxygen

Taken from Reference No. 95

TABLE 129

Insoluble Residue Values for an Unstable Distillate Fuel Stored at 54.4 °C (130 °F) for Six Weeks in Various Containers

Container	Insoluble Residue[1] mg/100 ml	
Borosilicate bottle	9.4,	9.2
Borosilicate bottle + borosilicate rod	8.7,	7.7
Soft glass bottle	7.0,	6.6
Soft glass bottle + soft glass rod	3.2,	2.9

[1] Results given for duplicate storage samples.

Taken with permission from Reference No. 24

TABLE 130

Soluble Gum Values for a Stable Distillate Fuel Stored at 54.4 °C (130 ° F) for 126 Days in Various Containers

Container	Soluble Gum[1] mg/100 ml	
Borosilicate bottle	10.6,	10.2
Borosilicate bottle + Borosilicate rod	9.2,	11.4
Soft glass bottle	5.4,	7.0
Soft glass bottle+ soft glass rod	4.4,	5.4
Soft glass bottle (used)		6.8
Borosilicate bottle (used)		10.6
Teflon-coated borosilicate bottle	8.4,	9.6

[1]Results given for duplicate storage samples

Taken with permission from Reference No. 24

TABLE 131

Effects of Glass Container on Distillate Fuel Storage Stability[1]

Storage Container	Light Transmission, %	Light Scatter, 45°[2]	Soluble Gum, mg./100 ml.
	After 42 Days		
Soft glass bottle	76.7, 78.5	33, 33	—
+ Borosilicate rod	78.4, 78.3	34, 35	—
Borosilicate bottle	63.5, 63.4	44, 45	—
+ soft glass rod	72.3, 72.2	36, 36	—
Vycor bottle	63.5, 63.6	49, 50	—
	After 82 Days		
Soft glass bottle	61.9, 62.2	56, 58	7.0, 6.0
Alkali wash	64.7; 65.2	54, 55	3.4, 5.6
Acid wash	66.6, 64.9	55, 53	3.4, 3.8
Borosilicate bottle	47.9, 48.7	149, 132	8.8, 11.4
Alkali wash	48.7, 50.3	138, 111	11.6, 10.2
	After 60 Days		
Soft glass bottle, fresh	70.5, 70.4	54, 54	—
Used	67.5, 66.8	51, 53	—
+ acid treatment[3]	65.9, 65.9	52, 51	—
+ alkali treatment[4]	72.5, 72.5	50, 50	—
+ soft glass rod	75.1, 74.9	51, 51	—
+ lead glass rod	68.3, 68.1	83, 86	—

[1]Stored at 54.4 °C [130 °F]
[2]Ratio of light intensity at 45 ° to intensity at 0 °
[3]Filled with 35% nitric acid, heated for 4 hours in boiling water bath, rinsed thoroughly
[4]Filled with 10% sodium hydroxide solution, heated for 4 hours in boiling water bath, rinsed thoroughly

TABLE 132

Stability Data for Distillate Fuels Aged in Borosilicate and Soft Glass Bottles[1]

Fuel No.[2]	Insoluble Residue, mg./600 g		Adherent Gum, mg./600 g.		Total Insolubles, mg./600 g		Soluble Gum, mg./100 ml.			Light Transmission, %		
	Boro.	Soft	Boro.	Soft	Boro.	Soft	Orig.	Boro.	Soft	Orig.	Boro.	Soft
D137	0.3	0.1	0.3	0.3	0.6	0.4	3.9	5.7	3.8	94.8	78.9	82.9
	0.4	0.0	0.3	0.2	0.7	0.2		5.1	2.1		78.4	83.9
D140	8.0	7.8	12.8	7.3	20.8	15.1	8.7	17.5	17.7	68.2	34.5	35.7
	9.6	6.6	12.2	7.1	21.8	13.7		19.9	13.2		33.3	36.6
D141	21.6	18.4	22.7	14.7	44.3	33.1	5.6	22.4	---	84.1	30.5	33.6
	20.6	16.3	19.8	16.0	40.4	32.3		21.2	10.0		30.5	37.0
C142	14.9	4.2	2.2	1.6	17.1	5.8	2.4	4.8	2.9	90.5	60.0	76.4
	13.4	3.0	2.9	1.4	16.3	4.4		4.1	3.2		60.4	76.9
D143	10.7	9.8	3.9	2.2	14.6	1.20	12.5	18.3	15.3	27.8	17.9	14.9
	13.2	8.8	0.9	0.0	14.1	8.8		14.7	23.6		16.9	14.9
D144	16.5	11.2	0.6	4.4	17.1	15.6	2.5	29.5	25.2	71.8	15.7	20.2
	17.5	11.5	0.5	2.6	18.0	14.1		29.7	21.3		14.7	20.6
D145	33.1	29.0	4.1	2.0	37.2	31.0	3.1	14.3	12.6	92.5	41.0	47.1
	37.1	29.8	3.7	3.8	40.8	33.6		19.7	9.6		38.1	46.2
D148	33.6	7.7	---	---	---	---	12.4	9.1	9.7	---	---	---
	37.1	9.8	---	---	---	---	---	9.8	9.1	---	---	

[1]Aged 16 hours at 98.9 °C (210 °F)
[2]Eight distillate fuels in the No. 2 burner oil and diesel fuel volatility range.

LE 133

Storage Data For Fuels Used For Navy-CRC Storage Program
Percent Light Transmission

Condition and Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Barge Storage, Ambient Temp.												
0 Months	86	84	82	80	90	90	89	88	86	87	95	95
6 Months[2]	82	78	71	71	71	71	76	78	67	65	94	93
9 Months	75	73	63	65	58	58	66	67	51	53	93	93
12 Months	77	74	66	63	58	58	65	66	48	53	93	93
18 Months	71	68	60	60	45	50	54	47	41	42	95	94
24 Months	69	66	57	50	39	39	43	43	33	34	93	94
Drum Storage, Ambient Temp												
0 Months	83	83	77	75	95	94	87	85	87	87	96	96
3 Months	86	80	72	73	86	79	82	81	70	74	97	96
6 Months	74	74	64	61	58	63	63	63	51	46	93	94
9 Months	73	72	60	55	49	53	56	59	44	35	94	95
12 Months	72	73	60	58	43	48	51	54	44	33	92	92
15 Months	69	69	58	56	38	42	45	46	41	25	92	92
18 Months	65	61	51	47	28	30	33	29	33	18	93	93
24 Months	57	64	46	50	24	20	26	16	28	16	93	93
Bottle Storage, Ambient Temp.												
0 Months	83	83	77	75	95	94	87	85	87	87	96	96
3 Months	84	80	71	70	87	89	87	83	74	76	97	96
6 Months	71	69	60	63	54	60	62	58	43	44	94	94
9 Months	73	73	57	58	50	52	54	46	34	33	95	94
12 Months	71	72	58	55	46	48	52	44	32	31	94	93
15 Months	63	65	60	47	37	38	45	33	25	22	94	94
18 Months	65	66	47	50	23	26	31	22	16	14	93	94

Table 133 Continued on next page

[1] Fuel Abbreviations: WMC -- Western Midcontinent
EMC -- Eastern Midcontinent
WT -- West Texas
RM -- Rocky Mountain
SR -- Straight Run
CC -- Catalytically Cracked

[2] Data are questionable because of contamination from sample containers

Taken from Reference No. 27

TABLE 133

Storage Data For Fuels Used For Navy-CRC Storage Program
Percent Light Transmission--Continued

Condition And Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Glass Pipe Storage												
0 Months	84	84	80	80	88		88		88		94	
12 Months	57	57	45	46	33		22		13		94	
Bottle Storage, 80 ° F												
0 Months	85	82	79	75	90	91	88	87	82	83	94	93
3 Months	82	80	75	72	74	79	75	73	65	65	96	96
6 Months	81	77	69	66	57	62	59	55	46	46	90	92
Bottle Storage, 85 ° F												
6 Months	84	80	73	73	73	59	75	75	54	55	96	96
12 Months	75	73	52	60	39	39	39	28	30	28	94	94
Bottle Storage 90 ° F												
0 Months	82	73	92	73	88	88	88	88	82	86	95	95
6 Months	75	75	60	57	50	50	60	60	45	40	96	96
12 Months	74	70	62	51	56	56	38	38	26	26	95	95
Bottle Storage, 110 ° F												
0 Weeks	89	84	76	77	93	94	86	84	86	85	96	95
13 Weeks[2]	35	34	21	24	3	3	3	3	3	3	80	77
26 Weeks	44	51	42	41	5	5	14	17	11	11	77	75
39 Weeks	48	55	43	46	3	3	14	17	13	12	80	79
52 Weeks	45	53	40	43	3	3	12	17	12	12	83	80
65 Weeks	49	55	43	45	3	3	12	17	11	11	80	75
Bottle Storage, 110 ° F												
0 Weeks	90	90	82	82	-	90	-	90	-	90	-	95
4 Weeks	88	90	80	80	-	80	-	82	-	73	-	95
8 Weeks	82	82	70	70	-	58	-	60	-	48	-	95
12 Weeks	70	72	57	59	-	45	-	45	-	34	-	95
16 Weeks	59	70	46	57	-	32	-	34	-	20	-	95

Table 133 Continued on next page

[1] Fuel Abbreviations: WMC -- Western Midcontinent
EMC -- Eastern Midcontinent
WT -- West Texas
RM -- Rocky Mountain
SR -- Straight Run
CC -- Catalytically Cracked

[2] Lumetron not adjusted properly.

Tak Reference No. 27

TABLE 133

Storage Data For Fuels Used For Navy-CRC Storage Program
Percent Light Transmission -- Continued

Condition And Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Bottle Storage, 110 ° F												
0 Weeks	86	82	79	75	90	91	88	87	82	83	94	93
6 Weeks	66	68	62	64	56	59	60	58	50	41	86	90
12 Weeks	59	63	42	50	25	25	34	27	27	25	90	90
Bottle Storage, 110 ° F												
0 Weeks	82	73	82	73	88	88	88	88	82	86	95	95
6 Weeks	75	75	72	72	68	63	72	72	55	48	95	95
12 Weeks	72	72	68	68	45	45	55	49	37	38	95	95
18 Weeks	75	69	50	50	37	37	30	36	45	25	25	95
24 Weeks	76	75	50	60	33	25	25	30	25	25	95	95
Bottle Storage, 110 ° F												
0 Weeks	85	82	97	66	69	-	90	-	85	-	97	-
3 Weeks	82	76	76	76	-	-	-	-	76	-	-	-
6 Weeks	76	66	73	61	61	-	76	-	61	-	97	-
9 Weeks	66	60	53	46	46	-	57	-	46	-	97	-
12 Weeks	-	66	53	49	41	-	49	-	41	-	97	-
Bottle Storage, 110 ° F												
0 Weeks	88	86	82	81	93	-	92	-	88	-	96	-
6 Weeks	74	74	65	70	65	-	63	-	58	-	94	-
12 Weeks	73	72	60	57	51	-	47	-	50	-	94	-
18 Weeks	60	71	50	60	31	-	34	-	33	-	92	-
24 Weeks	61	63	52	53	20	-	25	-	25	-	93	-

[1] Fuel Abbreviations: WMC -- Western Midcontinent
EMC -- Eastern Midcontinent
WT -- West Texas
RM -- Rocky Mountain
SR -- Straight Run
CC -- Catalytically Cracked

Taken from Reference No. 27

TABLE 134

Storage Data For Fuels Used For Navy-CRC Storage Program
Insoluble Gum, mg/100 ml

Condition And Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Barge Storage, Ambient Temp.												
0 Months	1.5	1.0	1.2	1.3	1.0	1.0	1.1	1.4	1.3	1.3	0.9	0.8
6 Months	1.3	1.0	1.3	1.0	1.8	1.8	1.8	1.9	2.2	2.1	1.1	1.5
9 Months	1.1	1.0	1.2	1.1	2.1	2.0	2.6	2.5	1.5	1.6	1.3	1.1
12 Months	1.2	1.3	1.5	1.1	1.9	1.9	2.1	2.4	1.4	1.9	1.1	1.0
18 Months	0.9	1.1	1.4	2.1	2.6	1.8	2.4	2.7	1.8	1.7	1.0	1.0
24 Months	1.0	1.0	1.2	1.3	2.0	1.8	1.9	2.4	1.9	1.3	0.7	0.9
Drum Storage Ambient Temp.												
0 Months	0.5	0.3	0.8	0.5	0.8	0.5	0.5	0.6	0.4	0.5	0.5	0.5
18 Months	-	-	-	-	-	-	-	-	-	-	-	-
24 Months	1.4	0.2	2.3	0.7	7.2	7.9	14.5	14.8	9.1	14.8	0.3	0.3
Bottle Storage, Ambient Temp.												
0 Months	0.5	0.3	0.8	0.5	0.8	0.5	0.5	0.6	0.4	0.5	0.5	0.5
3 Months	0.8	1.0	0.7	0.5	0.6	0.5	0.9	1.2	0.5	0.5	0.7	0.9
6 Months	1.3	0.7	1.4	0.9	1.7	2.3	3.2	4.1	3.1	2.9	0.9	0.8
9 Months	1.4	0.8	1.8	0.7	3.2	3.0	5.6	7.3	6.8	6.9	0.4	0.4
12 Months	2.2	1.4	2.5	1.0	4.0	3.8	6.7	8.3	9.7	8.2	0.6	0.8
15 Months	1.7	0.8	2.3	0.7	4.4	4.5	9.3	10.6	10.4	10.3	1.1	0.9
18 Months	2.4	1.2	3.1	0.9	6.2	5.9	11.3	13.6	11.7	12.4	1.1	1.0
Glass Pipe Storage												
24 Months	1.9	1.2	2.0	2.4	5.2	-	12.2	-	10.7	-	0.9	-
Bottle Storage, 80 °F												
0 Months	-	-	-	-	-	-	-	-	-	-	-	-
3 Months	0.5	0.5	0.4	0.6	1.1	0.9	0.9	1.3	0.7	0.4	0.4	0.2
6 Months	0.7	1.2	1.5	0.5	2.1	1.5	3.0	4.5	3.7	2.9	0.7	0.5

Table 134 Continued on next page

[1] Fuel Abbreviations: WMC -- Western Midcontinent
EMC -- Eastern Midcontinent
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Taken from Reference No. 27

TABLE 134

Storage Data For Fuels Used For Navy-CRC Storage Program
Insoluble Gum, mg/100 ml -- Continued

Condition And Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Bottle Storage, 85 °F												
6 Months	1.1	0.6	1.2	0.6	3.0	2.9	5.6	7.4	6.9	6.2	0.7	0.5
12 Months	1.1	0.5	2.2	0.5	6.3	5.9	9.8	14.7	11.0	12.0	0.8	0.5
Bottle Storage, 90 °F												
0 Months	1.7	1.4	2.4	1.7	1.0	1.6	1.3	1.9	1.6	1.7	0.7	0.7
6 Months	1.2	0.8	1.0	0.5	2.4	1.4	5.0	1.8	3.8	7.1	1.3	1.5
12 Months	0.7	0.6	0.9	0.6	3.8	3.1	5.1	7.3	1.3	1.6	0.8	0.6
Bottle Storage, 110 °F												
0 Weeks	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.2	0.0	0.0	0.2	0.2
13 Weeks	2.1	1.0	3.3	1.2	4.9	4.8	9.4	11.1	9.4	9.8	1.6	1.5
26 Weeks	3.6	1.4	5.1	2.1	9.6	9.4	16.4	22.4	16.6	18.9	3.8	4.5
39 Weeks	4.5	2.2	5.1	3.0	13.3	13.2	19.2	26.0	21.0	21.8	3.2	3.7
52 Weeks	5.9	3.5	6.1	4.0	16.9	16.5	22.9	29.7	24.7	25.2	1.5	2.2
65 Weeks	8.2	3.9	6.5	3.7	19.3	19.1	25.8	33.9	27.6	28.2	2.6	5.4
Bottle Storage, 110 °F												
0 Weeks	0.3	0.2	0.4	0.3	-	0.3	-	0.3	-	0.4	-	0.4
4 Weeks	0.8	0.9	0.9	0.7	-	0.9	-	1.6	-	1.0	-	0.5
8 Weeks	0.9	0.6	1.5	0.7	-	2.5	-	5.3	-	3.9	-	0.6
12 Weeks	1.1	0.8	2.0	1.3	-	6.8	-	11.2	-	0.9	-	1.0
16 Weeks	1.3	0.8	2.3	1.1	-	7.7	-	11.3	-	7.4	-	0.9

Table 134 Continued on next page

[1] Fuel Abbreviations: WMC -- Western Midcontinent
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Taken from Reference No. 27

TABLE 134

Storage Data For Fuels Used For Navy-CRC Storage Program
Insoluble Gum, mg/100 ml – Continued

Condition And Duration Of Storage	70% WMC SR[1] 30% WMC CC	70% WMC SR 30% WMC CC 0.01% Add #2	50% WMC SR 50% WMC CC	50% WMC SR 50% WMC CC 0.01% Add. #2	50% WT SR 50% WT CC	50% WT SR 50% WT CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC	50% EMC SR 50% EMC CC 0.02% Add. #1	50% EMC SR 50% EMC CC 0.02% Add #1	100% RM SR	100% RM SR
Bottle Storage, 110 ° F												
0 Weeks	-	-	-	-	-	-	-	-	-	-	-	-
6 Weeks	0.9	0.6	1.0	0.2	2.0	1.4	2.1	2.5	2.1	3.8	0.1	0.5
12 Weeks	2.2	2.8	3.4	1.2	5.6	5.8	8.2	10.6	9.0	9.4	0.9	1.0
Bottle Storage, 110 ° F												
0 Weeks	1.7	1.4	2.4	1.7	1.0	1.6	1.3	1.9	1.6	1.7	0.7	0.7
6 Weeks	0.4	0.0	0.5	0.2	0.8	0.4	0.8	1.3	1.2	0.9	0.0	0.0
12 Weeks	1.7	1.2	2.3	1.8	4.2	3.1	5.9	9.2	5.3	6.1	0.8	0.9
18 Weeks	2.2	1.3	2.7	1.7	5.0	4.1	8.5	11.3	4.5	6.9	0.6	0.8
24 Weeks	1.7	1.6	1.8	1.7	4.9	3.6	8.8	12.4	3.9	4.1	0.3	0.4
Bottle Storage, 110 ° F												
0 Weeks	0.2	0.3	0.5	0.9	1.1	-	0.4	-	0.3	-	1.6	-
3 Weeks	0.8	0.3	0.7	0.1	-	-	-	-	0.1	-	-	-
6 Weeks	1.1	0.3	1.8	0.8	2.3	-	3.4	-	4.1	-	0.2	-
9 Weeks	2.0	0.6	2.0	1.5	4.5	-	6.6	-	6.8	-	0.5	-
12 Weeks	2.1	0.8	2.4	1.7	6.0	-	8.2	-	6.3	-	0.2	-
Bottle Storage, 110 ° F												
0 Weeks	0.4	0.5	0.5	0.7	0.5	-	0.4	-	0.6	-	0.3	-
6 Weeks	0.2	0.1	1.5	0.0	0.6	-	0.7	-	0.4	-	0.3	-
12 Weeks	0.0	0.1	0.6	0.1	1.8	-	3.9	-	7.7	-	0.1	-
18 Weeks	1.4	0.0	-	0.1	3.5	-	6.2	-	-	-	0.0	-
24 Weeks	0.7	0.1	1.7	0.1	3.8	-	6.5	-	10.8	-	0.1	-

[1] Fuel Abbreviations: WMC – Western Midcontinent
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Taken from Reference No. 27