

TABLE 157

Inspection and Test Data on a Typical SRC-II Fuel Oil Compared to No. 6 Fuel Oils and Blends of SRC-II Fuel Oil with No. 6 Fuel Oil.

	SRC-II Fuel Oil	Low Sulfur No. 6 (0.06% N)	Low Sulfur No. 6 and SRC-II 50% Blend	Venezuela No. 6	Venezuela and SRC-II 50% Blend	Waxy No. 6 Fuel Oil	Waxy No. 6 Fuel Oil and SRC-II 50% Blend
Gravity, API, D287	8.3	15.3	11.5	13.8	11.3	32.2	19.8
Viscosity, Kin, D445, cs.							
100 °F.	8.64	1158	45.62	875	40.19	-	-
122 °F	4.48	417	25.11	382	23.18	-	-
210 °F	1.57	35.69	5.49	33.83	5.22	5.10	3.23
Pour Point: °F	-50	+75	+50	+30	-5	+135	+110
Nitrogen, Wt. %	0.98	0.46	0.74	0.41	0.70	0.046	0.48
Sulfur, D1552: Wt. %	0.24	0.52	0.35	2.27	1.27	0.13	0.18
Carbon Residue, Con. D189: Wt. %	0.44	10.2	5.25	11.0	5.80	0.86	0.59
Total Acid No. D664: Mg KOH/G	1.2	0.58	0.38	0.43	0.29	-	0.41
Total Base No. D664: Mg KOH/G	7.0	1.5	5.0	1.1	4.1	0.19	4.3
Sulfated Ash: Wt. %	0.008	0.18	0.02	0.07	0.04	0.03	0.019
Asphaltenes, IP 143: Wt. %	0.04	0.07	1.28	-	3.35	0.12	1.24
Sediment, D473: Wt. %	0.03	0.06	0.04	0.05	0.21	0.05	0.02
Nickel, ppm	0.1	33	15	43	21	1.5	0.4
Vanadium, ppm	0.1	4.9	2.6	185	88	0.8	0.2
Thermal Stability, D1661							
Unwashed, Thimble Rating	1	1	1	1	1	1	1
Washed, Thimble Rating	1	1	1	1	1	1	1
Wiped, Washed Thimble Rating	1	1	1	1	1	1	1
Rating of Tube	1	1	1	1	1	1	1
Pumpability Test, IP 230/69							
8 Poise, Min. Hand. Temp: °F	Below +35	109.0	82.5	108.5	44.5	125.0	101.5
10 Poise: °F	Below +35	97.5	58.0	93.5	39.0	117.0	89.0
25 Poise, Min. Line or Storage Temp: °F	Below +35	86.5	46.0	78.5	39.0	109.0	82.0
Insolubles, Procedure B, D893: Wt. %							
N-Pentane	0.05	3.33	0.95	9.89	5.92	12.8	3.04
Toluene	0.05	0.29	0.35	1.50	0.09	3.8	1.71
Resins	0.00	3.04	0.60	8.39	5.83	9.0	1.33
—After 5 months storage at 47.8 °C (118 °F)—							
Viscosity, Kin, D445, cs.							
100 °F	6.85	1194	54.66	1064	37.29	-	-
122 °F	4.55	397	28.23	413	20.63	-	-
210 °F	1.61	35.97	5.93	37.86	4.92	-	-
Pour Point: °F	-45	+80	+60	+35	+10	-	-
Asphaltenes, IP 143: Wt. %	0.46	-	1.63	7.20	3.92	-	-
Sediment, D473: Wt. %	0.02	0.03	0.03	0.04	0.03	-	-
Pumpability Test, IP 230/69							
8 Poise: °F	Below +39	110.0	66.5	108.5	50.5	-	-
10 Poise: °F	Below +39	99.5	61.5	97.5	Below +39	-	-
25 Poise: °F	Below +39	87.0	48.0	80.5	Below +39	-	-
Insolubles, Procedure B, D893: Wt. %							
N-Pentane	0.23	3.64	1.99	10.00	4.46	-	-
Toluene	0	0.13	0.45	0.10	0	-	-
Resins	0.23	3.51	1.54	9.90	4.46	-	-

From Reference No. 106

TABLE 158

Sediment Formation by Some Shale Middle Distillates with Moderate to High Nitrogen Contents

Sample ¹	Nitrogen Content (ppm)		Total Sediment ² (mg / 100 cc) After					
	Total	Pyrrrole	28 Days	60 Days	70 Days	84 Days	120 Days	156 Days
A-4	3,600	181	46.9	--	114	--	155.3	--
A-6	12,000	496	297	--	506	--	821.5	--
C-2 ³	3,900	--	48.4	--	131	--	240.7	--
C-3	4,100	58	39.1	74.1	--	129.2	198	--
C-4	10,000	538	79.6	191	--	--	409	500

¹"A" Samples are hydrotreated shale distillates, boiling range 325-640 °F.²"C" Samples are hydrotreated shale distillates, boiling range 325-700 °F.³Adherent plus insoluble; average of 3 replicates unless noted; storage at 43.3 °C (110 °F).⁴Single replicate due to small sample size.

Taken from Reference No. 39

Sediment And Gum Formation With Some Shale Middle Distillates With Low Nitrogen Contents

Gum and Total Sediment ¹ After										
Nitrogen Content (ppm)		Steam Jet Gum, 2, 4 mg/100 cc	28 Days		56 Days		120 Days		187 Days Sediment mg/100 cc	
			Replicate	Gum mg/100 cc	Sediment mg/100 cc	Gum mg/100 cc	Sediment mg/100 cc	Gum mg/100 cc		Sediment mg/100 cc
Sample ³	Total	Pyrrrole N								
A-1	480	9.3								
			1	4	0	4	10.6	Trace	Trace	
			2		0		6.6	"	"	
			3		0		11.6	"	"	
			Avg.		0		9.6	"	"	
A-3	240	10.7								
			1	5.8	0	0	5.4	5.1	10.5	
			2	3.4	0	0	5.2	5.8	11.8	
			3		0	0	5.0	7.0	11.6	
			Avg.	4.6	0	0	5.2	6.0	11.5	
B-1	340	8.76								
			1	15.0	0	Trace		1.1	9.4	
			2	17.8	0	"	32.2	3.0	7.9	
			3		0	"	24.2	2.7	8.5	
			Avg.	16.4	0	"	28.2	1.8	9.0	
B-3	360	5.20 [7.2] ⁵								
			1	4.4	0	0	5.4	0.7	4.4	
			2	5.8	0	0	4.8	1.4	2.1	
			3		0	0	10.4	0.8	5.5	
			Avg.	5.1	0	0	6.7	1.0	4.0	
C-1	420	7.34								
			1	4	0	Trace		5.6	5.8	
			2		0	"		4.8	4.8	
			3		0	"			4.5	
			Avg.		0	"				

¹Total of insoluble plus adherent sediment.

²ASTM Method D-381

³"A" samples are hydrotreated shale distillates, boiling range 325-640 °F.

⁴"B" samples are hydrotreated shale distillates, boiling range 325-670 °F.

⁵"C" samples are hydrotreated shale distillates, boiling range 325-700 °F.

⁶Steam jet gum not determined for heavy samples (C-1), gum not determined at 56 or 187 days or at 28 days for A-1.

⁷Replicate measurement.

Taken from Reference No. 39

Table 160
Accelerated Storage Stability Tests With Oak Ridge Shale Oils

Oil	Inspections ¹				Storage Stability ⁴		
	N ppm	S ppm	Pyroole N (ppm) ²	Exist. Gum ^{2, 3} (mg/100 ml)	Acid No. (mg KOH/g)	Total Sediment ⁵ (mg/100 ml) After	
						28 Days	70 Days
							120 Days
JP-5 Precursor	3800 ²	0.4	71.7	12.6	0.032	1.5	4.2
							7.2
JP-8 Precursor	3900 ²	1.0	123.2	21.0	0.070	8.0	16.0
							22.0
DFM Precursor	3600	0.6	194	31.6	0.037	4.3	10.5
							17.2
JP-5 Product	22	15	.02	0.0	0.000	0.0	0.0
							0.8
JP-8 Product	0.5	0.6	8.1	1.6	0.002	0.0	0.0
							1.1
DFM Product	15	7.0	1.3	0.6	0.001	0.0	0.0
							0.6

¹Reported by Oak Ridge National Labs unless otherwise noted.

²Exxon values.

³Sum of adherent plus insoluble values.

⁴Storage at 43.3 °C (110° F) in dark.

⁵Sum of adherent and insoluble sediments; avg. of three replicates.

Taken from Reference No. 39

Interactions Between DMP And Various Hydrotreated Shale Liquids¹

Shale Liquid	N Content (ppm)	DMP Added (ppm M)	Total Sediment ² (mg/100 cc) After					Interaction Type (Significance) ³
			28 Days	56 Days	70 Days	84 Days	120 Days	
A-1	480	None	0	0	-	-	Trace	
None	150	150	40.9	74.5	-	-	134.3	
A-1	480	150	18.4	52.2	-	-	110.4	Neg (S)
A-4	3600	None	70.3	-	112.2	-	155.3	
None	150	150	40.9	-	110.0	-	134.3	
A-4	480	150	203.5	-	354.6	-	454.2	Pos (HS)
A-6 ⁴	1300 ⁴	None	41.7	89.1	-	-	-	
None	150	150	40.9	74.5	-	-	-	
A-6 ⁴	1300	150	241.8	310.1	-	-	-	Pos (HS)
B-1	340	None	0	Trace	-	Trace	-	
None	150	150	40.9	74.5	-	90.0	-	
B-1	340	150	22.2	50.4	-	74.0	-	Neg (HS)
C-1	420	None	0	0	-	-	4.5	
None	150	150	40.9	74.5	-	-	134.3	
C-1	420	150	24.1	60.5	-	-	139.3	Neg (HS at 28, 56)
C-3	4100	None	39.1	86.5	-	138.5	-	
None	150	150	40.9	74.5	-	90.0	-	
C-3	4100	150	143.2	275.6	-	430.0	-	Pos (HS)
C-4	10 000	None	79.6	161.8	-	-	362.1	
None	150	150	40.9	74.5	-	-	134.3	
C-4	10 000	150	99.4	175.3	-	-	335.2	Neg (7 - S)
JP-B Prod.	0.5	None	0	0	0	-	0.8	
None	150	150	40.9	-	110.00	-	134.3	
JP-B Prod.	0.5	150	29.7	-	56.9	-	110.7	Neg (HS)
JP-B Prec.	3900	None	4.3	-	10.5	-	22.0	
None	150	150	40.9	-	110.0	-	134.3	
JP-B Prec.	3900	150	78.9	-	153.4	-	282.0	Pos (HS)

¹ Stored at 43.3 °C (110 °F) in dark. DMP sediment "alone" based on No. 2 diesel studies.

² Sum of Insoluble plus adherent sediments.

³ Students test: Pos = "positive"; Neg = "negative" or stabilizing.

(HS) = highly significant; (S) = significant;

(?) = doubtful

⁴ Diluted 1:10 with No. 2 diesel oil before DMP was added.

Taken from Reference No. 39

TABLE 162

Interactions Between Thiophenol, DMP And Some Shale Liquids¹

Shale Liquid	Thiophenol (ppm S)	DMP (ppm N)	Total Sediment (mg/100 cc) ² After				Interactive Effect of Thiophenol (Significance) ³
			28 Days	56 Days	84 Days	120 Days	
C-3 ⁴	None	None	39.1	86.5	129.2	197.7	Neg (?)
C-3	1000	None	59.2	80.1	--	144.4	
C-3	None	150	143.2	276.5	--	--	Neg (S) Neg (HS)
C-3	1000	150	117.8	249.4	--	--	
C-3	3000	150	4.8	11.3	--	--	Neg (?)
C-4 ⁵	None	None	79.6	161.8	251.7	--	
C-4	1000	None	53.6	164.7	226.5	--	Neg (HS)
C-4	None	150	99.4	--	--	--	
C-4	3000	150	7.1	--	--	--	

¹Stored at 43.3 °C (110 °F) in dark.²Sum of insoluble plus adherent; average of three replicates.³Students test

Neg = "negative" or stabilizing"; (?) = doubtful;

(S) = significant; (HS) = highly significant.

⁴Hydrotreated shale liquid, boiling range 325-700 °F, 4100 ppm Nitrogen⁵Hydrotreated shale liquid, boiling range 325-700 °F, 1 % Nitrogen

Taken from Reference No. 39

Table 163
43 °C (110 °F) Storage Stability Tests on Alternative Fuels (mg / 100 ml)

Description	Initial total gum	4 Weeks				8 Weeks				16 Weeks				32 Weeks			
		Insoluble precipitate	Adherent gum	Soluble gum	Total gum	Insoluble precipitate	Adherent gum	Soluble gum	Total gum	Insoluble precipitate	Adherent gum	Soluble gum	Total gum	Insoluble precipitate	Adherent gum	Soluble gum	Total gum
Naphtha - EDS Illinois No. 6	145	2.7	0.9	318	317	6.1	1.8	500	502	5.0	2.3	575	577	12.1	54.9	876	935
Naphtha - EDS Wydolak	258	3.4	1.2	505	506	5.4	5.8	800	806	4.0	7.0	972	979	6.4	35.6	1035	1071
Naphtha - SRC-11	17.6	1.4	0.8	92	93	0.1	1.7	104	106	9.3	0.8	197	198	11	145	387	532
Middle distillate SRC-11	19.6	0.1	0.4	156	156	0.02	2.4	328	330	1.0	23.3	372	395	1.3	8.7	1620	1629
Heavy distillate SRC-11	18298	---	---	---	6434	---	---	---	7305	---	---	---	---	---	---	---	---
Gas oil- tar sands	17895	0.4	0.5	1460	1461	3.0	3.8	1205	1214	0.6	5.0	1900	1905	0.2	6.0	7432	7438
Kerosene- tar sands	0.1	0.2	2.8	9.8	12.0	0	1.5	12.9	14.4	0.4	1.4	6.6	8.0	0.4	1.2	28.9	30.1
Naphtha- tar sands	2.3	0.1	0.5	0.8	1.3	0.1	1.2	2.9	4.1	0.3	0.5	5.8	6.3	0.3	1.2	19.5	20.7

Taken from Reference No. 17

TABLE 164

Effect of 43.3 °C (110 °F) Storage Stability Tests on Acid Numbers and Viscosities of Alternative Fuels

Description	Initial			4 Weeks			8 Weeks			16 Weeks			32 Weeks		
	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹	Vis @37.8 °C, (10 ⁻⁶ m ² s ⁻¹)	TAN ¹ mg(KOH)g ⁻¹
Naphtha - SRC-II	0.01	0.63		0.06	0.60	0.63	0.06	0.63	0.14	0.66	0.53	0.68			
Middle distillate-SRC-II	0.26	3.40		0.19	3.33	3.38	0.28	3.38	0.43	3.48	1.04	3.47			
Heavy distillate-SRC-II	0.21	54.91		0.11	59.23	61.03	0.13	61.03	0.37	65.42	NA	NA			
Gas oil - tar sands	0.05	20.91		0.03	21.01	20.92	0.04	20.92	0.85	21.08	0.01	20.07			
Kerosene - tar sands	0.02	1.99		0.01	1.98	1.98	0.03	1.98	0.03	1.99	0.06	2.04			
Naphtha - tar sands	0.03	NA ²		0.05	NA	NA	0.05	NA	0.01	NA	0.10	NA			

¹ TAN = Total acid number² NA = Not analyzed

Taken from Reference No. 17

TABLE 165

Dissolved Oxygen and Peroxide Numbers in Alternative Fuels Stored at 43.3 °C (110 °F)

Description	Initial			4 Weeks			8 Weeks			16 Weeks			32 Weeks		
	Dissolved O ₂ (ppm)	Peroxide number ¹	Peroxide number ¹	Dissolved O ₂ (ppm)	Peroxide number ¹	Peroxide number ¹	Dissolved O ₂ (ppm)	Peroxide number ¹	Peroxide number ¹	Dissolved O ₂ (ppm)	Peroxide number ¹	Peroxide number ¹	Dissolved O ₂ (ppm)	Peroxide number ¹	Peroxide number ¹
Naphtha - EDS Illinois No. 6	38	0.5		59	2	2	61	2	2	56	2	2	62	2	2
Naphtha - EDS Wyodak	40	1.3		51	2	2	60	2	2	63	2	2	52	2	2
Naphtha - SRC-II	63	0		---	---	---	---	---	---	---	---	---	86	13.8	13.8
Middle distillate-SRC-II	8	0.5		---	---	---	---	---	---	---	---	---	62	18	18
Kerosene - tar sands	35	12		---	---	13	---	14	15	---	15	15	23	198	198

¹ Peroxide number is defined as the gram-equivalents of active oxygen in 1000 liters of fuel.² Too dark.

Taken from Reference No. 17

TABLE 166
Insolubles from Shale Derived Diesel Fuel Marine¹ With Added 2,5-Dimethylpyrrole²

mg/100 ml					
N Added (ppm-w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	- 0.1	0.1	0.0		
	0.0	- 0.2	- 0.2	- 0.1	± 0.1
45	7.7	1.0	8.7		
	8.5	0.8	9.3	9.0	± 0.4
45 ³	7.9	0.9	8.8		
	7.4	0.8	8.2	8.6	± 0.4
135	23.3	1.8	25.1		
	23.2	1.4	24.6	24.9	± 0.4
270	51.1	3.0	54.1		
	48.9	3.0	51.9	53.0	± 1.6
450	94.9	4.2	99.1		
	96.3	4.4	100.7	99.9	± 1.1
450 ³	93.1	4.4	97.5		
	90.9	3.9	94.8	96.2	± 1.9

¹Additive-free, refined from Paraho crude shale oil.

²Aged at 43 °C for 52 days

³Flasks vented

Taken from Reference No. 47

TABLE 167
Insolubles from Shale Derived Diesel Fuel Marine¹ With Added 2,5-Dimethylpyrrole²

N Added (ppm-w/v)	mg/100 ml				
	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.0	- 0.3	- 0.3		
	0.0	- 0.4	- 0.4	- 0.3	± 0.1
45	14.8	1.2	16.0		
	16.9	1.8	18.7	17.4	± 1.9
45 ³	14.1	1.4	15.5		
	13.0	0.9	13.9	14.7	± 1.1
135	4	-	-		
	39.9	2.7	42.6	42.6	-
270	4	2.3	-		
	68.4	3.7	72.1	72.1	-
450	142.6	5.4	148.0		
	154.0	5.4	159.4	153.7	± 8.1
450 ³	142.1	5.6	147.7		
	131.8	5.1	136.9	142.3	± 7.6

¹Additive-free, refined from Paraho crude shale oil.

²Aged at 43 °C for 92 days.

³Flasks vented

⁴Sample lost.

Taken from Reference No. 47

TABLE 168
Insolubles from Shale Derived Diesel Fuel Marine¹ With Added 2,5-Dimethylpyrrole²

mg/100 ml					
N Added (ppm-w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	4 0.1	- 0.9	- 1.0	1.0	-
45	19.9 20.6	3.6 3.3	23.5 23.9	23.7	± 0.3
45 ³	19.8 18.3	3.0 2.8	22.8 21.1	22.0	± 1.2
135	61.0 55.0	4.4 4.6	65.4 59.6	62.5	± 3.8
270	149.6 120.6	7.3 6.5	156.9 127.1	142.0	± 21.1
450	213.3 220.8	10.2 10.2	223.5 231.0	227.3	± 5.3
450 ³	199.4 200.8	9.3 9.6	208.7 210.4	209.6	± ^x 1.2

¹ Additive-free, refined from Paraho crude shale oil.

² Aged at 43 °C for 129 days.

³ Flasks vented

⁴ Flask broken

Taken from Reference No. 47

TABLE 169
Insolubles from Shale Derived Diesel Fuel Marine¹ With Added 2,5-Dimethylpyrrole²

mg/100 ml					
N Added (ppm-w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.0	0.3	0.3		
	0.1	0.2	0.3	0.3	± 0.0
45	23.2	3.0	26.2		
	25.1	2.7	27.8	27.0	± 1.1
45 ³	22.9	2.3	25.2		
	22.2	2.4	24.6	24.9	± 0.4
135	73.0	5.5	78.6		
	72.1	4.9	77.0	77.8	± 1.1
270	151.8	8.7	160.5		
	147.5	8.0	155.5	158.0	± 3.5
450	258.1	12.6	270.7		
	203.6	11.9	215.5	243.1	± 39.0
450 ³	255.0	12.2	267.2		
	245.6	10.0	255.6	261.4	± 8.2

¹ Additive-free, refined from Paraho crude shale oil

² Aged at 43 °C for 179 days.

³ Flasks Vented

Taken from Reference No. 47

TABLE 170
Insolubles from Shale Derived Diesel Fuel Marine
With Antioxidant¹ And Added 2,5-Dimethylpyrrole²

N Added (ppm-w/v)	mg/100 ml				
	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.0	0.1	0.1	0.1	± 0.2
	0.1	0.1	0.2		
45	7.1	0.9	8.0	7.9	± 0.1
	5.8	1.0	7.8		
45 ³	7.0	0.8	7.8	7.6	± 0.3
	6.4	1.0	7.4		
135	24.2	1.8	26.0	25.4	± 0.9
	23.0	1.7	24.7		
270	54.6	3.0	57.6	58.1	± 0.7
	55.4	3.2	58.6		
450	89.9	4.1	94.0	97.3	± 4.7
	96.7	3.9	100.6		
450 ³	95.7	4.2	99.9	97.3	± 3.7
	90.4	4.2	94.6		

¹ 24 mg/l of 2, 4-dimethy-6-t-butylphenol added

² Aged at 43 °C for 52 days

³Flasks vented

Taken from Reference No. 47

TABLE 171
Insolubles from Shale Derived Diesel Fuel Marine¹ With Added 2,5-Dimethylpyrrole²

mg/100 ml

N Added (ppm-w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.0	0.3	0.3		
	0.0	0.1	0.1	0.2	± 0.1
45	4.9	0.5	5.4		
	4.8	0.4	5.2	5.3	± 0.1
45 ³	4.5	0.7	5.2		
	4.6	1.8	6.4	5.8	± 0.8
135	15.8	1.1	16.9		
	15.0	0.9	15.9	16.4	± 0.7
270	29.1	1.5	30.6		
	30.4	1.6	32.0	31.3	± 1.0
450	48.7	1.8	50.5		
	52.1	2.3	54.4	52.5	± 2.8
450 ³	51.7	2.1	53.8		
	49.0	2.3	51.3	52.6	± 1.8

¹ Additive-free, refined from Paraho crude shale oil

² Aged at 80 °C for 4 days

³ Flasks vented

Taken from Reference No. 47

TABLE 172
Insolubles from Shale Derived Diesel Fuel Marine
With Added 2,5-Dimethylpyrrole¹

N Added (ppm-w/v)	mg/100 ml				
	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.1	0.0	0.1		
	- 0.3	0.1	- 0.2	- 0.1	± 0.2
45	8.8	0.8	8.6		
	8.8	1.0	9.8	9.7	± 0.1
45 ²	8.2	1.3	9.5		
	8.1	1.0	9.1	9.3	± 0.3
135	28.9	2.1	31.0		
	27.5	1.9	29.4	30.2	± 1.1
270	55.7	3.1	58.8		
	55.2	3.0	58.2	58.5	± 0.4
450	93.0	3.9	96.9		
	79.0	3.3	82.3	89.6	±10.3
450 ²	93.0	3.3	96.3		
	89.9	3.4	93.3	94.8	± 2.1

¹ Aged at 80 °C for 7 days

² Flasks vented

ken from Reference No. 47

TABLE 173
Insolubles from Shale Derived Diesel Fuel Marine
With Added 2,5-Dimethylpyrrole¹

N Added (ppm-w/v)	mg/100 ml				
	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.2	0.4	0.6	0.6	±0.0
	0.2	0.4	0.6		
45	16.5	1.3	17.8	17.4	±0.6
	15.5	1.4	16.9		
45 ²	14.7	1.4	16.1	15.4	±1.0
	13.6	1.1	14.7		
135	49.0	2.4	51.4	52.8	±2.0
	51.3	2.9	54.2		
270	103.5	4.5	108.0	108.2	±0.3
	104.3	4.1	108.4		
	450	170.1	5.6	175.7	±2.3
	166.5	5.9	172.4	174.1	
450 ²	156.5	³	—	166.7	---
	160.9	5.8	166.7		

¹ Aged at 80 °C for 14 days

² Flasks vented

³ Flask broken

Taken from Reference No. 47

TABLE 174
Insolubles from Shale Derived Diesel Fuel Marine
With Added 2,5-Dimethylpyrrole¹

N Added (ppm-w/v)	mg/100 ml				
	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	14.9	42.6	57.5	38.1	± 27.4
	5.5	13.2	18.7		
45	25.4	3.5	28.9	29.6	± 0.9
	26.4	3.8	30.2		
45 ²	24.4	3.3	27.7	27.1	± 0.8
	23.2	3.3	26.5		
135	80.5	4.7	85.2	84.9	± 0.4
	79.3	5.3	84.6		
270	156.3	7.1	163.4	165.1	± 2.4
	160.2	8.8	168.8		
450	265.1	8.7	273.8	270.6	± 4.6
	258.0	9.3	267.3		
450 ²	232.7	7.8	240.5	237.0	± 5.0
	225.6	7.8	233.4		

¹ Aged at 80 °C for 28 days

² Flasks vented

Taken from Reference No. 47

TABLE 175
Insolubles from Shale Derived Diesel Fuel Marine with Antioxidant¹ and Added 2,5-Dimethylpyrrole²

N added (ppm-w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.1 0.0	0.0 0.0	0.1 0.0	0.1	± 0.1
45	4.0 3.4	0.6 1.4	4.6 4.8	4.7	± 0.1
45 ³	4.0 4.7	0.9 0.6	4.9 5.3	5.1	± 0.3
135	13.2 12.7	0.9 1.2	14.1 13.9	14.0	± 0.1
270	25.8 24.8	1.5 1.3	27.3 26.1	26.7	± 0.8
450	38.9 34.0	3.1 2.9	42.0 36.9	39.4	± 3.6
450 ³	43.9 46.2	3.0 2.9	46.9 49.1	48.0	± 1.6

¹ 24 mg/l of 2,4-dimethyl-6-t-butylphenol

² Aged at 77° C (170.6° F) for 4 days

³ Flask vented

Taken from Reference No. 47

TABLE 176
Insolubles from Shale Derived Diesel Fuel Marine With Antioxdant¹
And Added 2,5-Dimethylpyrrole²

mg/100 ml					
N added (ppm - w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Dev.
0	0.0	0.0	0.0	0.1	± 0.1
	0.1	0.0	0.1		
45	5.9	1.0	6.9	7.4	± 0.7
	6.9	1.0	7.9		
45 ³	6.8	1.1	7.9	7.9	± 0.1
	7.0	0.8	7.8		
135	21.4	1.8	23.2	21.5	± 2.5
	17.5	2.2	19.7		
270	30.7	3.4	34.1	34.1	—
	—	—	—		
450	53.7	3.8	57.5	67.5	± 14.1
	73.8	3.6	77.4		
450 ³	75.7	4.5	80.2	77.8	± 3.4
	71.7	3.7	75.4		

¹ 24 mg/l of 2,4-dimethyl-6-t-butylphenol added.

² Aged at 77 °C for 7 days

³ Flasks vented

Taken from Reference No. 47

TABLE 177
Insolubles from Shale Derived Diesel Fuel Marine With Antioxidant¹
And Added 2,5-Dimethylpyrrole²

mg/100 ml					
N added (ppm - w/v)	Filtered Sediment	Adherent Gum	Total Insolubles		
			Duplicates	Mean	Std. Deviation
0	-0.1	-0.2	-0.3		
	0.0	-0.1	-0.1	-0.2	± 0.1
45	13.8	1.3	15.1		
	11.8	1.5	13.3	14.2	± 1.3
45 ³	13.2	1.6	14.8		
	11.1	1.7	12.8	13.8	± 1.4
135	45.1	3.4	48.5		
	44.8	1.5	46.3	47.4	± 1.6
270	97.7	4.4	102.1		
	95.9	4.4	100.3	101.2	± 1.3
450	162.7	5.7	168.4		
	167.7	6.6	174.3	171.4	± 4.2
450 ³	161.6	6.1	167.7		
	154.8	4.8	159.6	163.7	± 5.7

¹ 24 mg/l of 2,4-dimethyl-6-t-butylphenol

² Aged at 80 °C for 14 days.

³ Flasks vented

Taken from Reference No. 47