

**Environment
Canada**

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Oil Composition and Properties for Oil Spill Modelling

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**Environmental Protection Service
Environmental Technology Advancement Directorate
Environmental Technology Centre
Emergencies Science and Technology Division**

Canada

1. Arabian Heavy [2004]

1.1 Origin

Saudi Arabia (courtesy of Irving Oil Ltd, Canaport NB, Canada)

1.2 Physical Properties

		Arabian Heavy [2004] % Evaporative Mass Loss			
		0.0%	7.3%	15.0%	23.2%
Density (g/mL)	5°C	0.8980	0.9208	0.9390	0.9579
	15°C	0.8923	0.9131	0.9315	0.9503
	30°C	0.8819	0.9027	0.9212	0.9394
API Gravity		27.0			
Dynamic Viscosity (mPa•s)	5°C	84.3	247.7	963.6	9451
	15°C	49.7	115.3	393.6	2416.7
	30°C	25.5	57.1	157.2	595.1
Hydrocarbon Groups (%w/w)	Saturates	60.1%	58.9%	53.3%	50.0%
	Aromatics	24.6%	25.2%	27.1%	27.5%
	Resins	6.3%	6.0%	8.9%	10.2%
	Asphaltenes	9.0%	9.9%	10.8%	12.2%
Surface Tension (mN/m)	5°C	27.6	NM	NM	NM
	15°C	27.2	28.3	29.6	NM
	30°C	26.5	28.2	29	29.9
Interfacial Tension (Oil/Water, mN/m)	5°C	NM	NM	NM	NM
	15°C	27.8	28.4	30.9	NM
	30°C	26.8	26.6	28	NM
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	NM	NM	NM	NM
	15°C	26.5	28.5	28.6	NM
	30°C	25.8	26.7	28.7	NM

Note: All values are the average of a minimum of three measurements.

1.3 GC-TPH Distributions

Fraction [†]	Arabian Heavy [2004] Concentration (mg/g oil)			
	0% evap.	7.3% evap.	15.0% evap.	23.2% evap.
Total GC-TPH [†]	538	545	551	509
GC-Saturates/GC-TPH [†]	70.9%	70.0%	66.3%	64.5%
GC-Aromatics/GC-TPH [†]	29.1%	30.0%	33.7%	35.5%
Resolved Peaks/GC-TPH	24.4%	22.0%	20.7%	16.2%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈ - ≤ to ≤ <i>n</i> -C ₁₀	60.5	43.3	20.8	0.99
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	134	136	148	101
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	286	308	324	345
<i>n</i> -C ₃₄ +	57.1	57.8	58.3	62.9

[†]Including both resolved peaks and unresolved complex mixture areas.

1.4 BTEX and Alkyl-benzene Distributions

	Arabian Heavy [2004] Concentration (mg/g oil)			
	0% evap.	7.3% evap.	15.0% evap.	23.2% evap.
Benzene	0.36	0.16	0.00	0.00
Toluene	1.89	1.40	0.04	0.00
Ethylbenzene	1.11	1.05	0.23	0.00
<i>meta</i> - and <i>para</i> -Xylene	2.33	2.21	0.59	0.00
<i>ortho</i> -Xylene	1.13	1.08	0.39	0.00
Sum BTEX	6.82	5.89	1.24	0.00
Isopropylbenzene	0.21	0.22	0.09	0.00
Propylbenzene	0.39	0.42	0.23	0.00
3- and 4-Ethyltoluene	1.84	1.94	1.17	0.00
1,3,5-Trimethylbenzene	0.66	0.67	0.44	0.00
2-Ethyltoluene	1.08	1.13	0.73	0.00
1,2,4-Trimethylbenzene	1.68	1.81	1.30	0.01
1,2,3-Trimethylbenzene	0.16	0.17	0.12	0.00
Sum C₃-benzenes	6.02	6.36	4.08	0.02
Isobutylbenzene	0.04	0.04	0.02	0.00
1-Methyl-2-isopropylbenzene	0.05	0.05	0.04	0.00
1,2-Dimethyl-4-ethylbenzene	0.55	0.57	0.54	0.05
Amylbenzene	0.08	0.09	0.14	0.02
n-Hexylbenzene	0.07	0.07	0.07	0.04
BTEX + C₃-benzenes	12.84	12.25	5.32	0.02
All Target BTEX and Alkyl-benzenes	13.63	13.07	6.13	0.13

1.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	Arabian Heavy [2004] Concentration (mg/g oil)			
	0% evap.	7.3% evap.	15.0% evap.	23.2% evap.
<i>n</i> -C ₈	6.26	4.99	0.35	0
<i>n</i> -C ₉	6.08	5.9	2.2	0
<i>n</i> -C ₁₀	5.8	5.95	4.45	0
<i>n</i> -C ₁₁	5.61	5.86	5.61	0.71
<i>n</i> -C ₁₂	5.06	5.36	5.58	2.61
<i>n</i> -C ₁₃	4.8	5.07	5.44	4.2
<i>n</i> -C ₁₄	4.35	4.82	5	5.01
<i>n</i> -C ₁₅	4.13	4.32	4.75	5.01
<i>n</i> -C ₁₆	3.62	3.76	4.08	4.58
<i>n</i> -C ₁₇	3.38	3.52	3.77	4.31
Pristane	0.78	0.82	0.87	1.02
<i>n</i> -C ₁₈	3.03	3.24	3.44	3.81
Phytane	1.2	1.26	1.34	1.53
<i>n</i> -C ₁₉	2.38	2.43	2.68	3.1
<i>n</i> -C ₂₀	2.29	2.35	2.63	2.92
<i>n</i> -C ₂₁	1.93	2.01	2.13	2.48
<i>n</i> -C ₂₂	1.63	1.7	1.87	2.21
<i>n</i> -C ₂₃	1.43	1.49	1.61	1.92
<i>n</i> -C ₂₄	1.29	1.35	1.51	1.73
<i>n</i> -C ₂₅	1.2	1.31	1.35	1.63
<i>n</i> -C ₂₆	1.08	1.17	1.29	1.49
<i>n</i> -C ₂₇	0.84	0.9	0.96	1.3
<i>n</i> -C ₂₈	0.76	0.78	0.8	1.08
<i>n</i> -C ₂₉	0.68	0.71	0.74	1.02
<i>n</i> -C ₃₀	0.59	0.6	0.63	0.78
<i>n</i> -C ₃₁	0.54	0.56	0.58	0.76
<i>n</i> -C ₃₂	0.45	0.49	0.51	0.63
<i>n</i> -C ₃₃	0.39	0.43	0.46	0.59
<i>n</i> -C ₃₄	0.34	0.37	0.37	0.5
<i>n</i> -C ₃₅	0.3	0.33	0.32	0.43
<i>n</i> -C ₃₆	0.26	0.31	0.31	0.34
<i>n</i> -C ₃₇	0.16	0.22	0.23	0.25
<i>n</i> -C ₃₈	0.14	0.16	0.18	0.2
<i>n</i> -C ₃₉	0.11	0.13	0.15	0.16
<i>n</i> -C ₄₀	0.1	0.12	0.14	0.15
<i>n</i> -C ₄₁	0.06	0.07	0.07	0.09
<i>n</i> -C ₄₂	0.04	0.05	0.06	0.07
<i>n</i> -C ₄₃	0.03	0.04	0.05	0.07
<i>n</i> -C ₄₄	0.02	0.03	0.04	0.06
TOTAL	73.1	75	68.5	58.8
C ₁₇ /PRISTANE	4.34	4.28	4.34	4.22
C ₁₈ /PHYTANE	2.53	2.56	2.56	2.49
PRISTANE/PHYTANE	0.65	0.65	0.65	0.67
Odd Alkanes	34	35.3	33.1	28
Even Alkanes	37.1	37.6	33.2	28.2
CPI	0.92	0.94	1	0.99

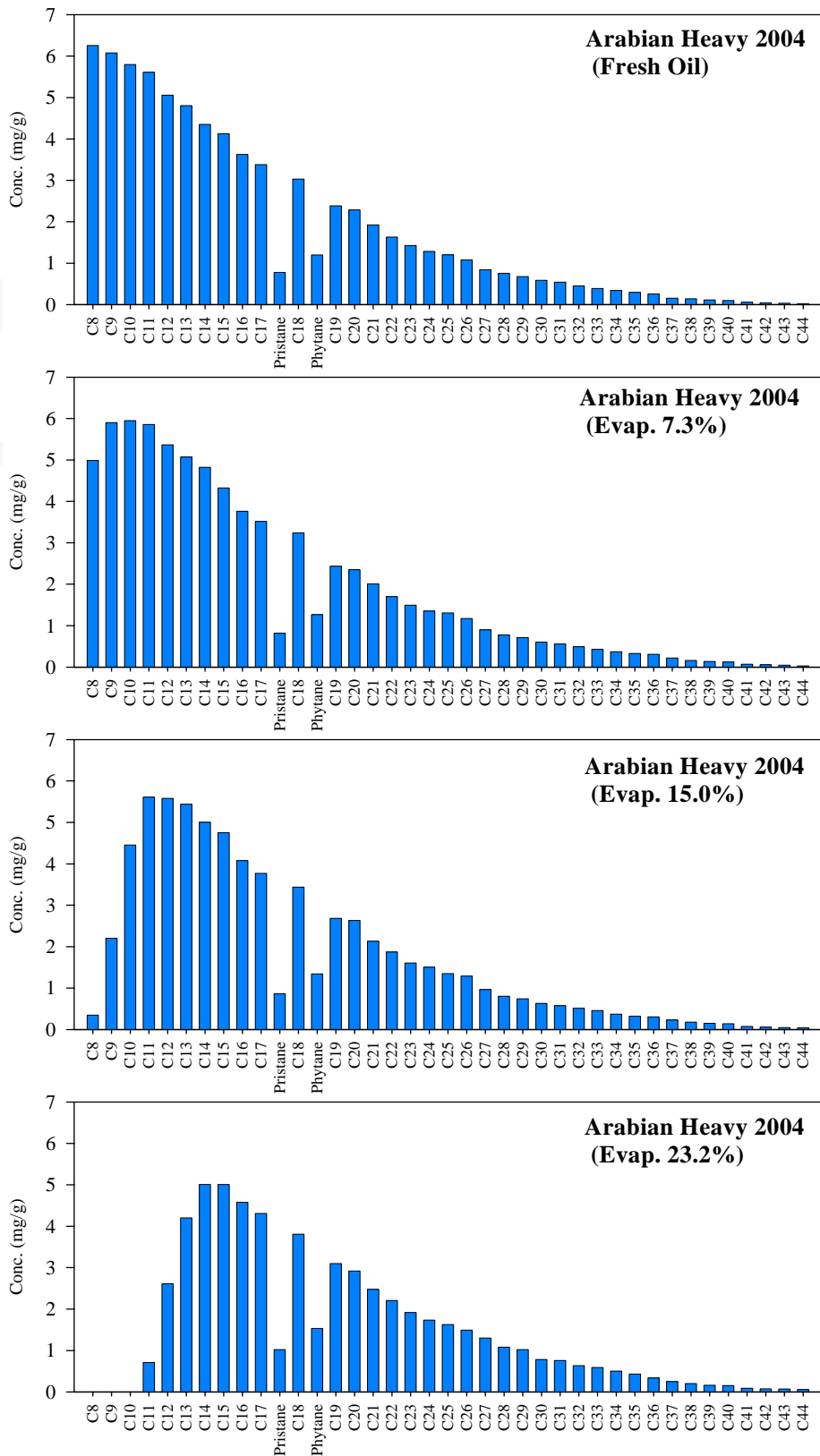


Figure 1 *n*-Alkane Distributions for Arabian Heavy [2004]

1.6 PAH Distributions

		Arabian Heavy [2004] Concentration ($\mu\text{g/g}$ oil)			
Alkylated PAHs		0% evap.	7.3% evap.	15.0% evap.	23.2% evap.
Naphthalene	C0-N	140	142	152	66.9
	C1-N	616	628	699	581
	C2-N	1262	1301	1440	1469
	C3-N	1625	1719	1902	2160
	C4-N	1096	1144	1262	1390
	Sum	4738	4934	5455	5667
Phenanthrene	C0-P	55.8	58.1	65.3	71.7
	C1-P	169	176	197	220
	C2-P	280	289	329	360
	C3-P	224	239	265	299
	C4-P	140	164	177	209
	Sum	868	926	1033	1160
Dibenzothiophene	C0-D	89.7	93.7	104	115
	C1-D	368	384	429	476
	C2-D	819	848	952	1066
	C3-D	955	970	1105	1227
	Sum	2232	2295	2590	2883
Fluorene	C0-F	29.2	31.2	33.7	35.8
	C1-F	80.5	83.6	94.4	103
	C2-F	169	177	193	218
	C3-F	277	302	315	323
	Sum	555	593	636	680
Chrysene	C0-C	10.3	10.7	11.8	13.2
	C1-C	21.9	23.3	25.6	29
	C2-C	39.1	43.8	45.7	50.2
	C3-C	33.9	35.2	42.9	43.7
	Sum	105	113	126	136
Total alkylated PAHs		8498	8861	9841	10527
C2-N/C1-N		1.16	1.16	1.16	1.11
Ratios of C3-D isomers		1.00:0.82:0.55	1.00:0.81:0.55	1.00:0.83:0.56	1.00:0.81:0.55
Ratio of C1-P isomers		1.45	1.47	1.44	1.46
(C2D/C2P):(C3D/C3P)		2.93:4.27	2.94:4.06	2.89:4.16	2.96:4.10
C0N:C1N:C2N:C3N:C4N		0.13:0.56:1.15:1.48:1.00	0.12:0.55:1.14:1.50:1.00	0.12:0.55:1.14:1.51:1.00	0.05:0.42:1.66:1.55:1.00
$\sum\text{N}:\sum\text{P}:\sum\text{DBT}:\sum\text{F}:\sum\text{C}$		5.46:1.00:2.57:0.64:0.12	5.33:1.00:2.48:0.64:0.12	5.28:1.00:2.51:0.62:0.12	4.88:1.00:2.48:0.59:0.12
EPA Priority PAHs					
Biphenyl		23.1	23.6	25.1	24.7
Acenaphthylene		7.65	8.2	8.57	9
Acenaphthene		4.42	4.57	4.87	5.39
Anthracene		1.75	1.84	2.11	2.22
Fluoranthene		1.89	1.93	2.1	2.27
Pyrene		4.01	4.12	4.61	5.06
Benz(a)anthracene		2.11	2.27	2.38	2.57
Benzo(b)fluoranthene		1.95	2.16	2.28	2.14
Benzo(k)fluoranthene		0.38	0.45	0.53	0.54
Benzo(e)pyrene		2.7	2.95	3.07	3.52
Benzo(a)pyrene		1.33	1.45	1.7	1.92
Perylene		0.97	0.98	0.98	1.11
Indeno(1,2,3cd)pyrene		0.31	0.32	0.33	0.33
Dibenzo(a,h)anthracene		0.37	0.39	0.4	0.4
Benzo(ghi)perylene		1.42	1.48	1.59	1.62
Total EPA Priority PAHs		54.4	56.7	60.6	62.8
TOTAL PAHs		8553	8918	9901	10589

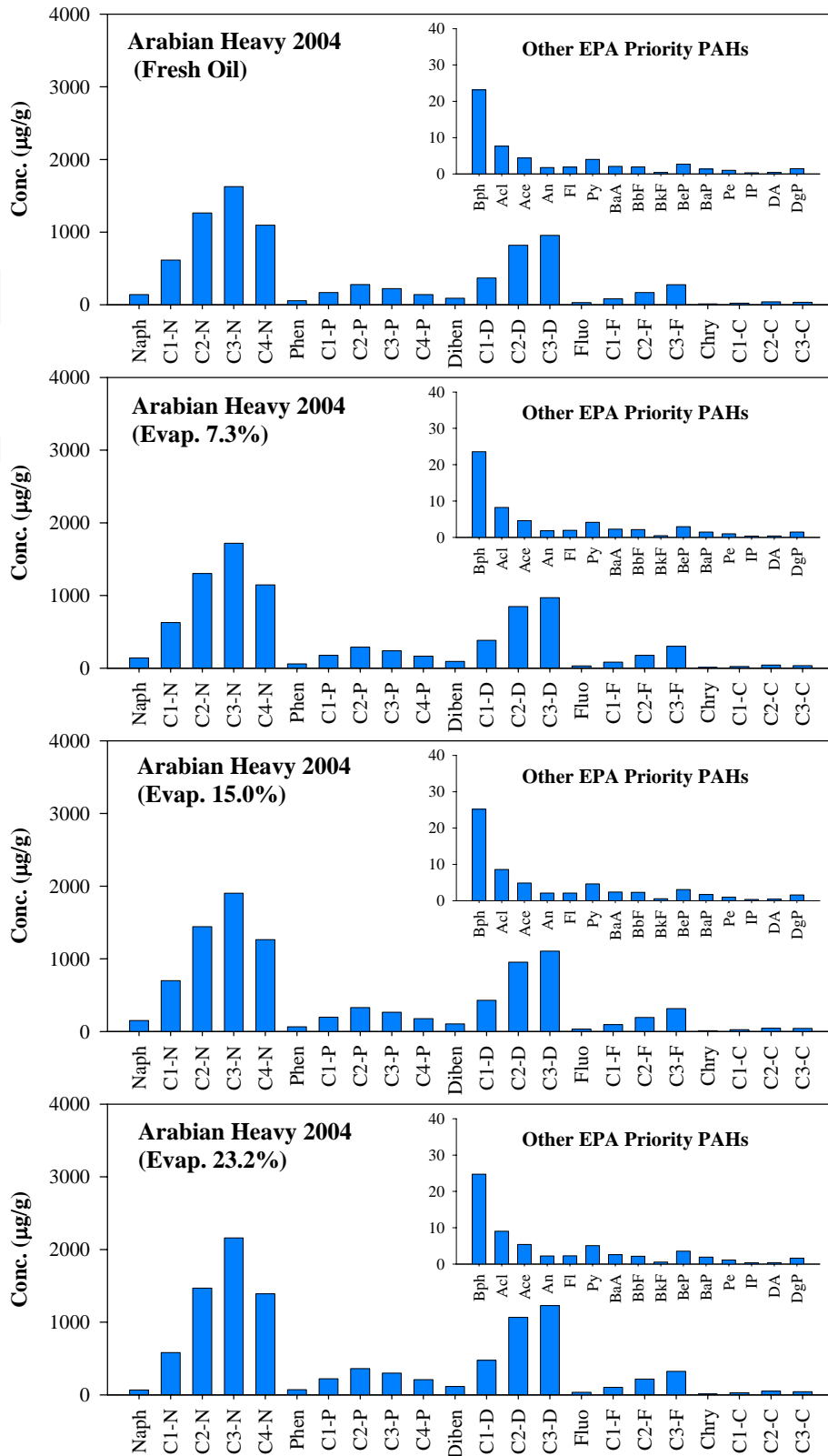


Figure 2 PAH Distributions for Arabian Heavy [2004]

1.7 Biomarker Distributions

Biomarker	Arabian Heavy [2004] Concentration ($\mu\text{g/g oil}$)			
	0% evap.	7.3% evap.	15.0% evap.	23.2% evap.
C21	4.78	5.27	6.39	6.45
C22	5.11	5.52	6.87	7.11
C23	19.2	20.4	23.5	25
C24	6.16	6.63	7.35	7.76
C29 hopane	268	284	316	342
C30 hopane	207	222	244	262
C31(S)	107	113	123	137
C31(R)	85	90.5	98.1	107
C32(S)	61.9	67	71.4	80
C32(R)	42.9	45.4	49.1	54.5
C33(S)	36.8	40	43.8	46.3
C33(R)	25.8	27.1	28.6	31.7
C34(S)	24.3	27.1	29.6	30.6
C34(R)	15	17.3	18.3	19.7
C35(S)	28.2	32.4	34.1	35.8
C35(R)	16.2	19	20.2	21.3
Ts	32.5	34	38.9	40.9
Tm	71.5	75.1	87	94.5
C27 $\alpha\beta$ steranes	114	121	138	149
C28 $\alpha\beta$ steranes	78.7	86.1	97.8	105
C29 $\alpha\beta$ steranes	151	160	174	193
TOTAL	1401	1498	1657	1797
C23/C24	3.11	3.08	3.2	3.22
C23/C30	0.09	0.09	0.1	0.1
C24/C30	0.03	0.03	0.03	0.03
C29/C30	1.29	1.28	1.3	1.31
C31(S)/C31(R)	1.26	1.25	1.26	1.28
C32(S)/C32(R)	1.44	1.47	1.45	1.47
Ts/Tm	0.45	0.45	0.45	0.43
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.75	0.76	0.79	0.77
Σ (C31 to C35) homohopanes	443	479	517	564
C30/ Σ (C31 to C35)	0.47	0.46	0.47	0.46

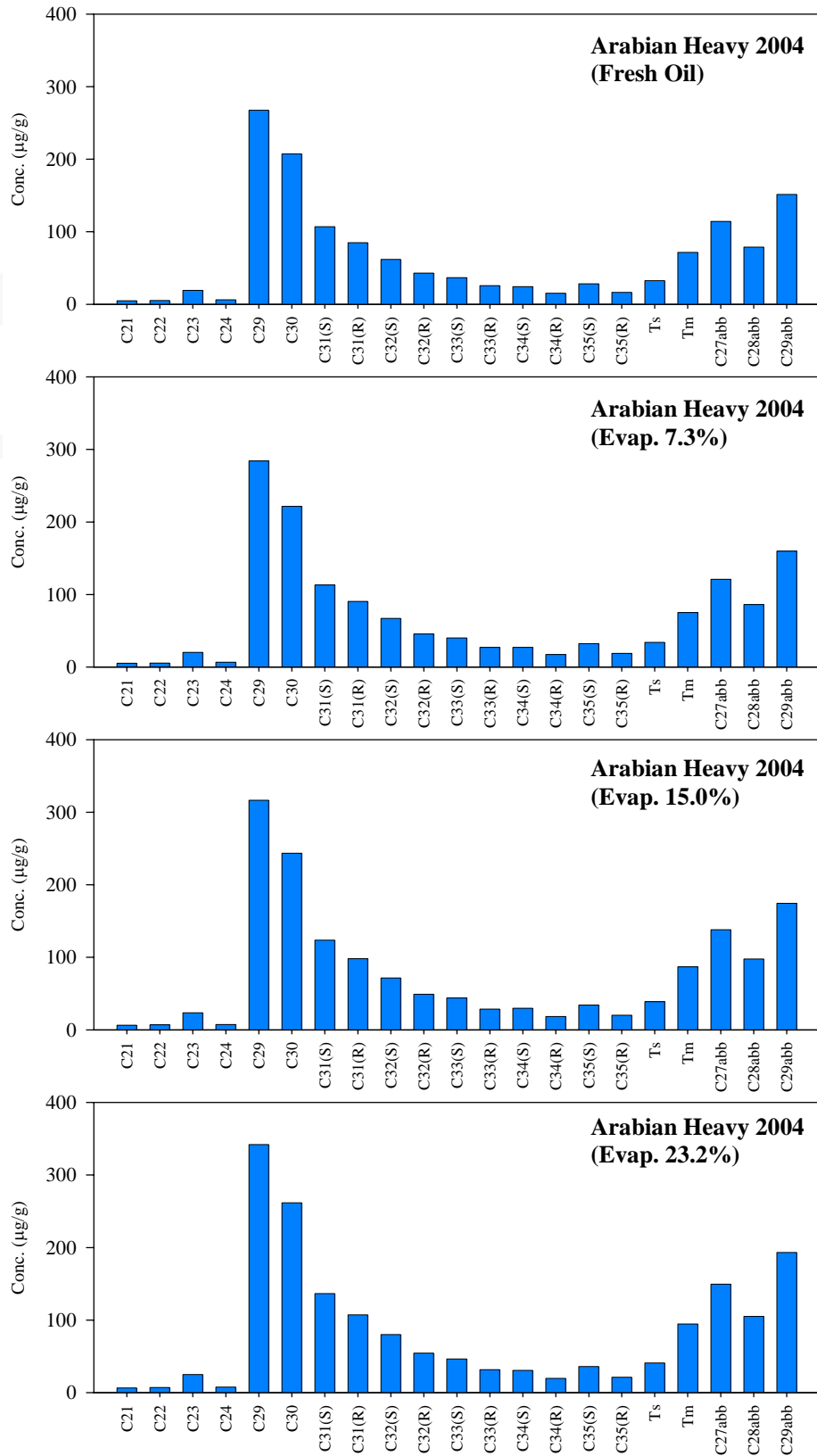


Figure 3 Biomarker Distributions for Arabian Heavy [2004]

2. Cook Inlet (2003)

2.1 Origin

Alaska, USA (2003)

2.2 Physical Properties

		Cook Inlet [2003]			
		% Evaporative Mass Loss			
		0.0%	11.4%	25.0%	34.4%
Density (g/mL)	5°C	0.8620	0.8848	0.9092	0.9262
	15°C	0.8544	0.8794	0.9028	0.9194
	30°C	0.8436	0.8689	0.8924	0.9085
API Gravity		34.0			
Dynamic Viscosity (mPa•s)	5°C	12.4	29.3	249.5	872.1
	15°C	8.2	16.8	56.4	238.9
	30°C	5.8	10.4	27	67
Hydrocarbon Groups (%w/w)	Saturates	66.7%	66.1%	63.4%	61.6%
	Aromatics	25.2%	24.2%	24.8%	25.1%
	Resins	5.1%	6.3%	7.3%	7.3%
	Asphaltenes	3.1%	3.5%	4.5%	6.0%
Surface Tension (mN/m)	5°C	24.4	28.1	30.4	30.9
	15°C	24.8	27.8	29.9	30.6
	30°C	25.5	27.4	29.1	30
Interfacial Tension (Oil/Water, mN/m)	5°C	26.5	28	30.4	32.7
	15°C	25	26.1	27.7	30
	30°C	23.2	23.2	24.3	26
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	24.6	23.3	31.3	32.6
	15°C	23.7	23.8	27.4	29.1
	30°C	22.3	23.3	23.6	24.8

Note: All values are the average of at least of three measurements.

2.3 GC-TPH Distributions

Fraction	Cook Inlet [2003] Concentration (mg/g oil)			
	0% evap.	11.4% evap.	25.0% evap.	34.4% evap.
Total GC-TPH [†]	601	630	678	653
GC-Saturates/GC-TPH [†]	73.5%	71.5%	69.7%	68.9%
GC-Aromatics/GC-TPH [†]	26.5%	28.5%	30.3%	31.1%
Resolved Peaks/GC-TPH	24.8%	25.2%	21.2%	17.5%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈₋ ≤ to ≤ <i>n</i> -C ₁₀	67.8	69.9	24.3	0.39
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	171	184	189	144
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	302	315	385	428
<i>n</i> -C ₃₄ +	59.8	61.2	79.9	80.4

[†]Including both resolved peaks and unresolved complex mixture areas.

2.4 BTEX and Alkyl-benzene Distributions

	Cook Inlet [2003] Concentration (mg/g oil)			
	0% evap.	11.4% evap.	25.0% evap.	34.4% evap.
Benzene	1.88	0.77	0.00	0.00
Toluene	4.17	3.33	0.03	0.00
Ethylbenzene	1.20	1.21	0.18	0.00
<i>meta</i> - and <i>para</i> -Xylene	3.09	3.09	0.60	0.00
<i>ortho</i> -Xylene	1.62	1.64	0.46	0.00
Sum BTEX	11.97	10.04	1.28	0.00
Isopropylbenzene	0.57	0.59	0.22	0.00
Propylbenzene	0.71	0.80	0.37	0.00
3- and 4-Ethyltoluene	1.35	1.47	0.80	0.00
1,3,5-Trimethylbenzene	0.68	0.71	0.43	0.00
2-Ethyltoluene	0.55	0.59	0.36	0.00
1,2,4-Trimethylbenzene	1.76	1.89	1.31	0.01
1,2,3-Trimethylbenzene	0.49	0.53	0.37	0.00
Sum C₃-benzenes	6.11	6.60	3.86	0.02
Isobutylbenzene	0.07	0.08	0.06	0.00
1-Methyl-2-isopropylbenzene	0.05	0.05	0.04	0.00
1,2-Dimethyl-4-ethylbenzene	0.46	0.49	0.45	0.06
Amylbenzene	0.06	0.08	0.08	0.03
<i>n</i> -Hexylbenzene	0.08	0.10	0.11	0.08
BTEX + C₃-benzenes	18.08	16.64	5.13	0.02
All Target BTEX and Alkyl-benzenes	18.81	17.44	5.87	0.19

2.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	Cook Inlet [2003] Concentration (mg/g oil)			
	0% evap.	11.4% evap.	25.0% evap.	34.4% evap.
<i>n</i> -C ₈	5.43	4.95	0.27	0.00
<i>n</i> -C ₉	5.94	6.31	2.22	0.00
<i>n</i> -C ₁₀	5.33	5.96	4.97	0.06
<i>n</i> -C ₁₁	5.13	5.78	5.90	1.14
<i>n</i> -C ₁₂	5.07	5.56	6.17	3.82
<i>n</i> -C ₁₃	4.96	5.52	6.73	5.49
<i>n</i> -C ₁₄	4.76	5.38	6.31	6.32
<i>n</i> -C ₁₅	4.48	5.24	6.08	6.56
<i>n</i> -C ₁₆	4.07	4.89	5.73	6.03
<i>n</i> -C ₁₇	4.00	4.68	5.37	5.93
Pristane	2.62	3.08	3.52	3.90
<i>n</i> -C ₁₈	3.11	3.72	4.35	4.63
Phytane	1.18	1.39	1.64	1.75
<i>n</i> -C ₁₉	2.68	3.24	4.06	4.09
<i>n</i> -C ₂₀	2.51	3.10	3.65	3.87
<i>n</i> -C ₂₁	2.18	2.70	3.10	3.28
<i>n</i> -C ₂₂	2.10	2.50	2.87	3.21
<i>n</i> -C ₂₃	1.93	2.40	2.75	3.10
<i>n</i> -C ₂₄	1.93	2.30	2.71	2.89
<i>n</i> -C ₂₅	1.71	2.03	2.40	2.55
<i>n</i> -C ₂₆	1.48	1.76	2.00	2.11
<i>n</i> -C ₂₇	1.21	1.40	1.78	1.81
<i>n</i> -C ₂₈	1.06	1.20	1.41	1.51
<i>n</i> -C ₂₉	0.95	1.08	1.37	1.42
<i>n</i> -C ₃₀	0.72	0.85	1.10	1.11
<i>n</i> -C ₃₁	0.64	0.65	0.94	1.03
<i>n</i> -C ₃₂	0.42	0.45	0.56	0.59
<i>n</i> -C ₃₃	0.34	0.37	0.49	0.52
<i>n</i> -C ₃₄	0.32	0.36	0.47	0.49
<i>n</i> -C ₃₅	0.25	0.28	0.32	0.34
<i>n</i> -C ₃₆	0.11	0.12	0.13	0.14
<i>n</i> -C ₃₇	0.10	0.10	0.11	0.13
<i>n</i> -C ₃₈	0.09	0.09	0.10	0.12
<i>n</i> -C ₃₉	0.04	0.05	0.06	0.01
<i>n</i> -C ₄₀	0.04	0.04	0.06	0.07
<i>n</i> -C ₄₁	0.04	0.04	0.05	0.06
<i>n</i> -C ₄₂	0.04	0.04	0.05	0.06
<i>n</i> -C ₄₃	0.03	0.03	0.04	0.05
<i>n</i> -C ₄₄	0.03	0.03	0.03	0.03
TOTAL	79	89.7	91.8	80.2
C₁₇/PRISTANE	1.52	1.52	1.52	1.52
C₁₈/PHYTANE	2.64	2.68	2.66	2.65
PRISTANE/PHYTANE	2.22	2.22	2.15	2.24
Odd Alkanes	36.6	41.9	43.8	37.5
Even Alkanes	38.2	43.3	42.9	37.1
CPI	0.96	0.97	1.02	1.01

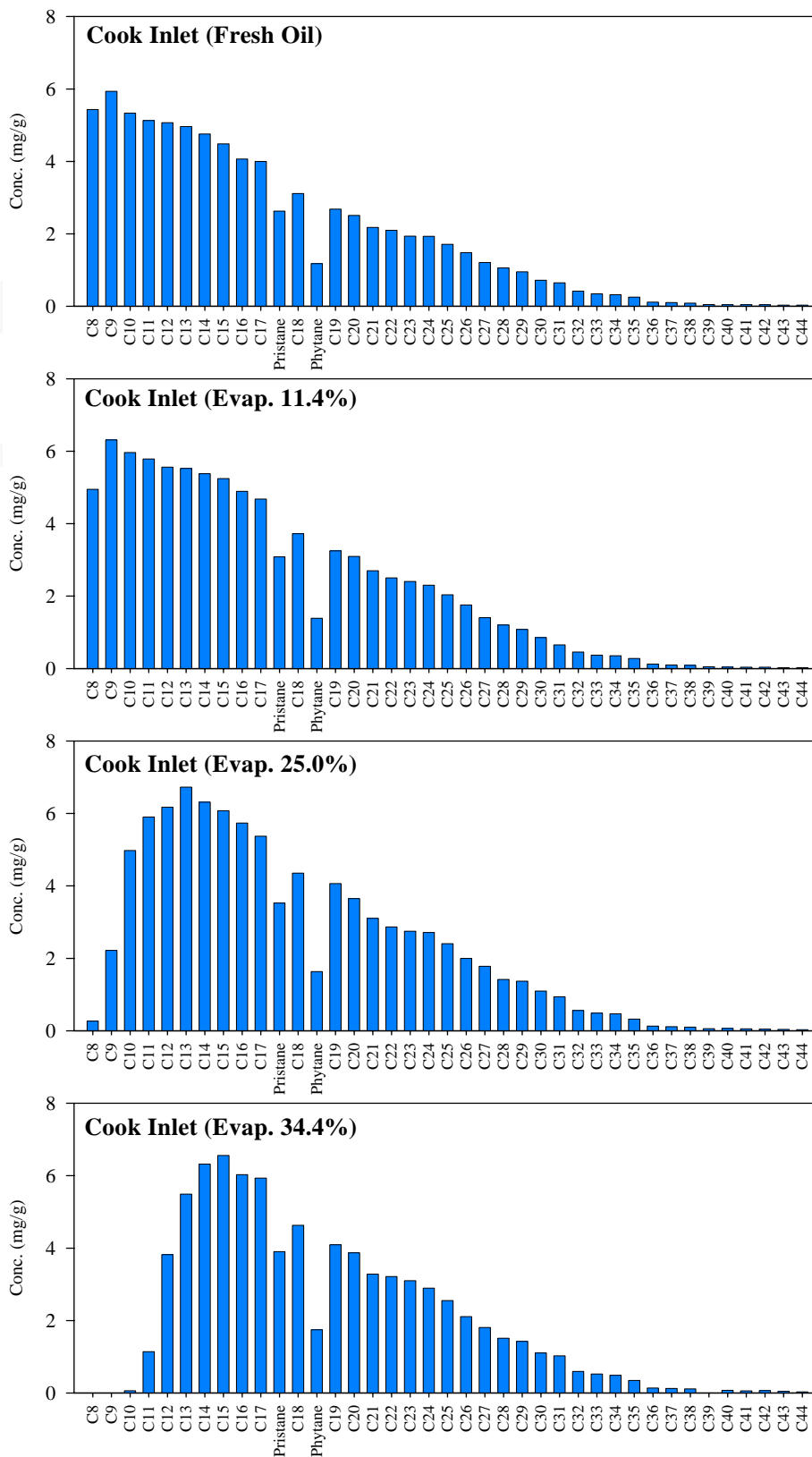


Figure 4 *n*-Alkane Distributions for Cook Inlet (2003)

2.6 PAH Distributions

		Cook Inlet [2003] Concentration (µg/g oil)			
Alkylated PAHs		0% evap.	11.4% evap.	25.0% evap.	34.4% evap.
Naphthalene	C0-N	579	634	638	300
	C1-N	1944	2180	2367	2069
	C2-N	2869	3241	3643	4037
	C3-N	2151	2499	2894	3528
	C4-N	1066	1235	1434	1876
	Sum	8610	9790	10977	11809
Phenanthrene	C0-P	296	310	369	457
	C1-P	618	668	806	998
	C2-P	604	700	869	1039
	C3-P	343	415	545	591
	C4-P	208	230	284	386
	Sum	2069	2323	2874	3471
Dibenzothiophene	C0-D	14.1	16.9	19.8	22.8
	C1-D	46.5	49.9	60.9	75.5
	C2-D	63.1	75.5	90.6	105
	C3-D	45.7	49.6	67.1	79
	Sum	169	192	238	282
Fluorene	C0-F	106	119	140	169
	C1-F	245	267	312	389
	C2-F	266	302	382	466
	C3-F	202	226	293	371
	Sum	819	914	1127	1395
Chrysene	C0-C	55.7	62.7	74.8	92.2
	C1-C	133	149	185	226
	C2-C	135	165	235	265
	C3-C	97.2	96.6	147	176
	Sum	421	473	642	759
Total alkylated PAHs		12088	13691	15858	17715
C2-N/C1-N		1.4	1.41	1.4	1.34
Ratios of C3-D isomers		1.00:0.33:0.17	1.00:0.33:0.15	1.00:0.33:0.15	1.00:0.32:0.15
Ratio of C1-P isomers		1.24	1.24	1.25	1.25
(C2D/C2P):(C3D/C3P)		0.10:0.13	0.11:0.12	0.10:0.12	0.10:0.13
C0N:C1N:C2N:C3N:C4N		0.54:1.82:2.69:2.02:1.00	0.51:1.77:2.62:2.02:1.00	0.45:1.65:2.54:2.02:1.00	0.16:1.10:2.15:1.88:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		4.16:1.00:0.08:0.40:0.20	4.21:1.00:0.08:0.39:0.20	3.82:1.00:0.08:0.39:0.22	3.40:1.00:0.08:0.40:0.22
EPA Priority PAHs					
Biphenyl		60.7	75.8	89.1	86.2
Acenaphthylene		12.5	21.8	27.2	27.8
Acenaphthene		18.6	18.4	17.5	19.3
Anthracene		10.6	15.5	19.5	23.1
Fluoranthene		4.93	6.7	7.42	8.59
Pyrene		13.9	18.7	21.6	26.4
Benz(a)anthracene		13.7	20.2	25.1	29.1
Benzo(b)fluoranthene		8.05	9.51	11.2	13.3
Benzo(k)fluoranthene		0.63	0.72	0.97	1.38
Benzo(e)pyrene		14.3	17.3	19.9	23.4
Benzo(a)pyrene		3.71	3.9	5.59	6.92
Perylene		2.93	3.85	4.59	5.48
Indeno(1,2,3cd)pyrene		0.63	0.73	0.91	1.03
Dibenzo(a,h)anthracene		2.46	3.11	3.21	4.26
Benzo(ghi)perylene		4.27	5.79	6.2	7.61
Total EPA Priority PAHs		172	222	260	284
TOTAL PAHs		12259	13913	16118	17999

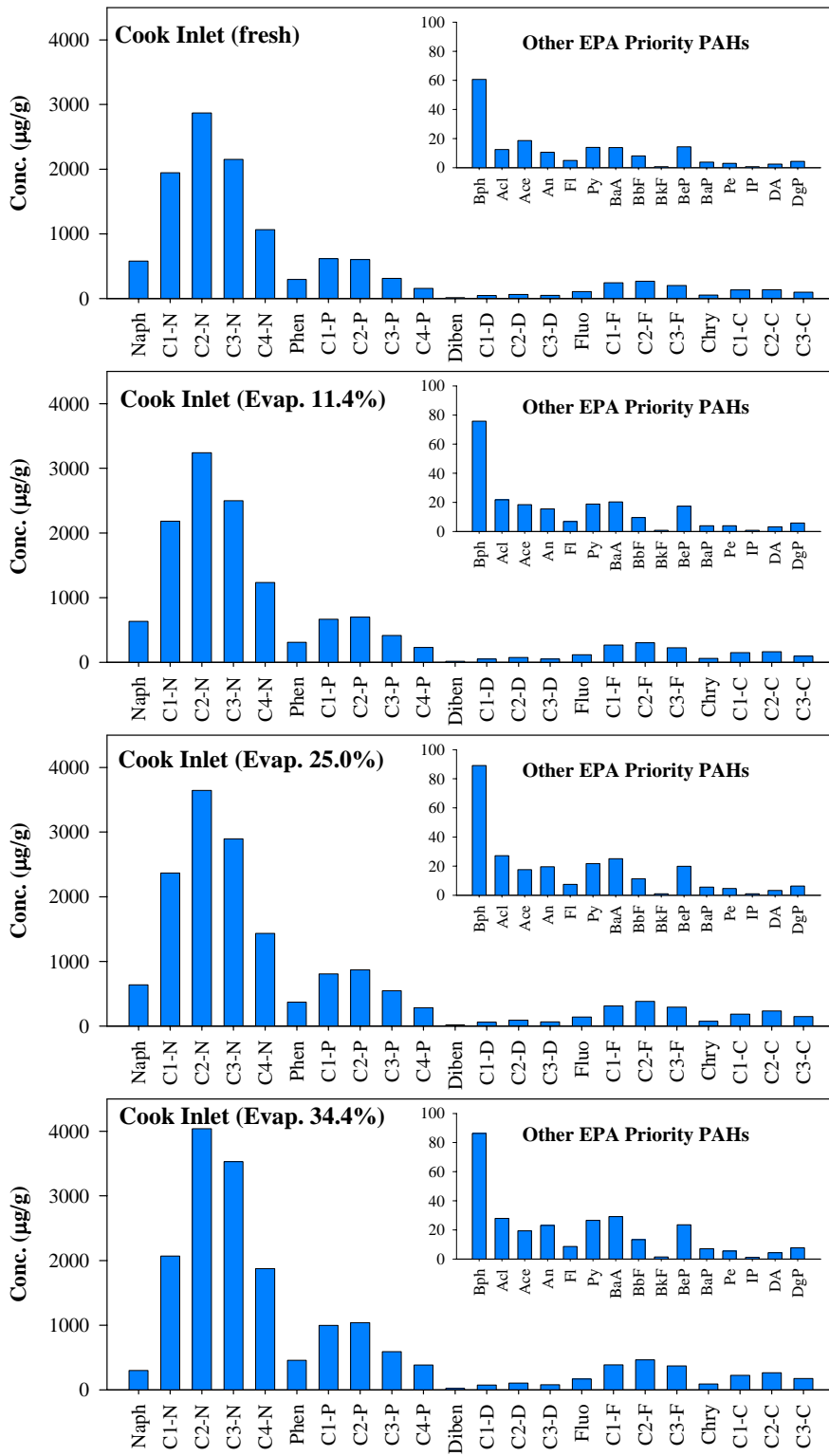


Figure 5 PAH Distributions for Cook Inlet [2003]

2.7 Biomarker Distributions

Biomarker	Cook Inlet [2003] Concentration ($\mu\text{g/g oil}$)			
	0% evap.	11.4% evap.	25.0% evap.	34.4% evap.
C21	7.12	8.49	9.32	10.7
C22	3.01	3.56	4.05	4.81
C23	9.22	9.65	10.7	12.3
C24	6.04	6.3	7.04	8.1
C29 hoane	45	49.6	56.1	62.6
C30 hopane	119	134	155	169
C31(S)	45	51.5	59.4	67
C31(R)	35.6	39.7	47.6	52.2
C32(S)	28	32.5	36.8	40.4
C32(R)	20.3	23.6	26.4	29.3
C33(S)	16.6	19	22.7	25.7
C33(R)	12.3	14.1	16.1	18.5
C34(S)	10.5	13.1	15.4	17.4
C34(R)	7.16	8	9.27	10.2
C35(S)	5.98	6.48	8.45	10.7
C35(R)	4.44	4.94	5.31	6.39
Ts	22.7	24.9	27	31.2
Tm	23.4	25.6	27.8	31.9
C27 $\alpha\beta$ steranes	183	200	230	263
C28 $\alpha\beta$ steranes	116	132	144	165
C29 $\alpha\beta$ steranes	229	248	284	325
TOTAL	949	1055	1203	1361
C23/C24	1.53	1.53	1.52	1.52
C23/C30	0.08	0.07	0.07	0.07
C24/C30	0.05	0.05	0.05	0.05
C29/C30	0.38	0.37	0.36	0.37
C31(S)/C31(R)	1.26	1.3	1.25	1.28
C32(S)/C32(R)	1.38	1.37	1.39	1.38
Ts/Tm	0.97	0.97	0.97	0.98
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.8	0.81	0.81	0.81
Σ (C31 to C35) homohopanes	186	213	248	278
C30/ Σ (C31 to C35)	0.64	0.63	0.63	0.61

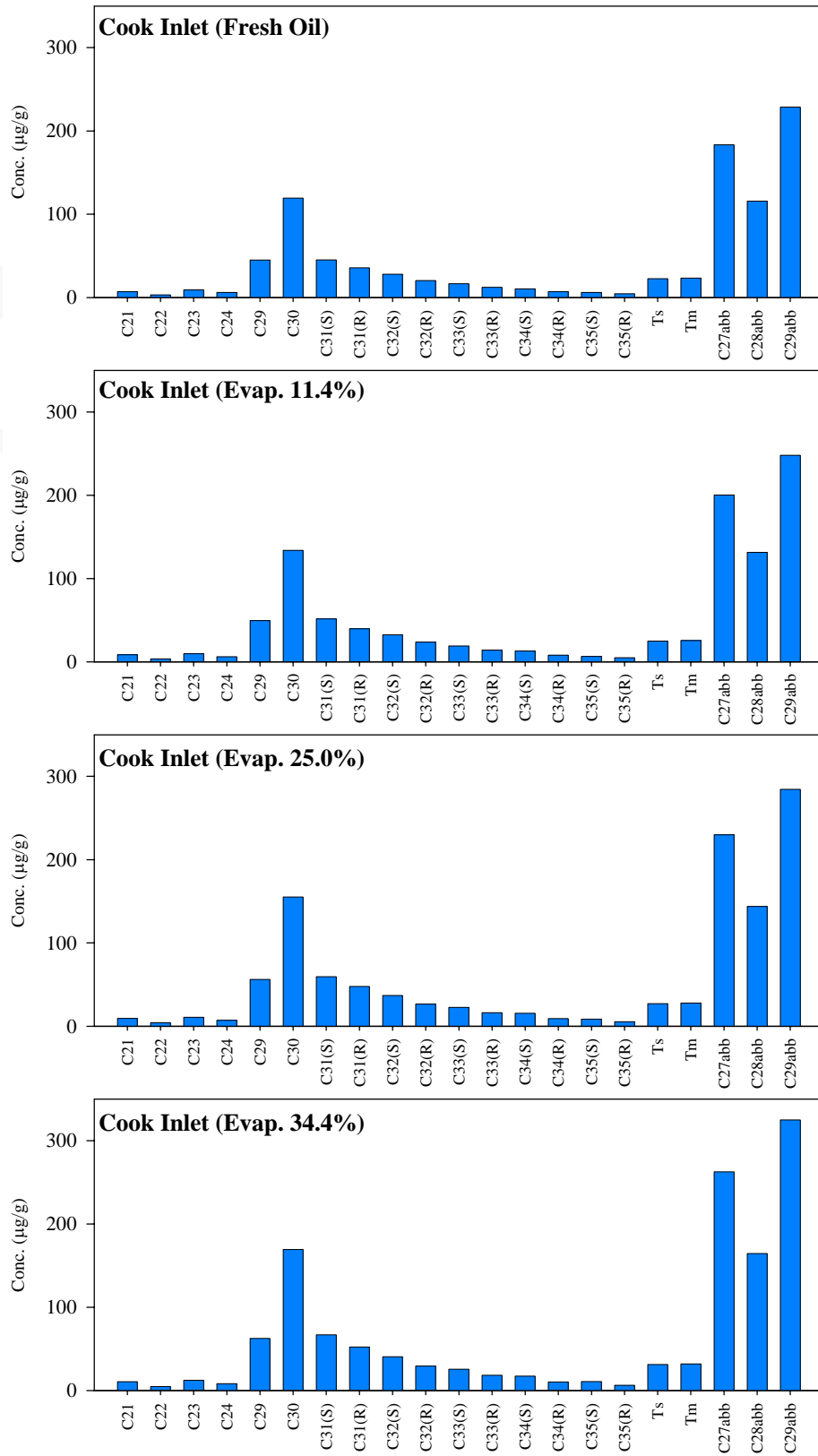


Figure 6 Biomarker Distributions for Cook Inlet (2003)

3. MARS TLP

3.1 Origin

Gulf of Mexico, U.S.A.

3.2 Physical Properties

		MARS TLP % Evaporative Mass Loss			
		0.0%	8.4%	17.2%	26.2%
Density (g/mL)	5°C	0.9006	0.9232	0.9422	0.9608
	15°C	0.8933	0.9162	0.9353	0.9537
	30°C	0.8831	0.906	0.9253	0.9437
API Gravity		26.8			
Dynamic Viscosity (mPa•s)	5°C	69	240.1	1051	7432
	15°C	33	93	404	2237
	30°C	25	57.4	171.9	738.4
Hydrocarbon Groups (%w/w)	Saturates	58.4%	55.0%	52.2%	46.7%
	Aromatics	27.5%	27.1%	28.3%	30.1%
	Resins	9.5%	11.5%	12.4%	14.7%
	Asphaltenes	4.7%	6.3%	7.1%	8.5%
Surface Tension (mN/m)	5°C	28.1	29.4	NM	NM
	15°C	26.2	28	29.6	30.8
	30°C	26.3	27.9	29.2	30.4
Interfacial Tension (Oil/Water, mN/m)	5°C	26.6	20	NM	NM
	15°C	21.3	21.1	16.2	NM
	30°C	25.3	20.1	21.1	20.2
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	25.5	20.2	NM	NM
	15°C	24.8	21.8	19.7	NM
	30°C	23.7	19.5	19.6	18.5

Note: All values are the average of a minimum of three measurements.

3.3 GC-TPH Distributions

Fraction	MARS TLP Concentration (mg/g oil)			
	0% evap.	8.4% evap.	17.2% evap.	26.2% evap.
Total GC-TPH	552	554	515	500
GC-Saturates/GC-TPH [†]	68.0%	67.0%	64.8%	60.8%
GC-Aromatics/GC-TPH [†]	32.0%	33.0%	35.2%	39.2%
Resolved Peaks/GC-TPH	18.9%	17.8%	15.2%	11.0%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈ ≤ to ≤ <i>n</i> -C ₁₀	60.3	54.8	20.5	1.44
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	141	137	129	90.4
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	298	306	307	342
<i>n</i> -C ₃₄ +	53.3	55.8	58.9	65.7

[†]Including both resolved peaks and unresolved complex mixture areas.

3.4 BTEX and Alkyl-benzene Distributions

	MARS TLP Concentration (mg/g oil)			
	0% evap.	8.4% evap.	17.2% evap.	26.2% evap.
Benzene	0.44	0.15	0.00	0.00
Toluene	2.20	1.52	0.06	0.00
Ethylbenzene	0.92	0.78	0.19	0.00
<i>meta</i> - and <i>para</i> -Xylene	2.87	2.62	0.76	0.00
<i>ortho</i> -Xylene	1.39	1.30	0.48	0.00
Sum BTEX	7.82	6.38	1.49	0.01
Isopropylbenzene	0.26	0.25	0.12	0.00
Propylbenzene	0.46	0.43	0.24	0.00
3- and 4-Ethyltoluene	1.64	1.56	0.97	0.00
1,3,5-Trimethylbenzene	0.79	0.85	0.57	0.00
2-Ethyltoluene	0.82	0.82	0.56	0.00
1,2,4-Trimethylbenzene	2.04	2.07	1.55	0.01
1,2,3-Trimethylbenzene	0.19	0.20	0.16	0.00
Sum C₃-benzenes	6.21	6.18	4.16	0.01
Isobutylbenzene	0.04	0.05	0.03	0.00
1-Methyl-2-isopropylbenzene	0.05	0.06	0.04	0.00
1,2-Dimethyl-4-ethylbenzene	0.56	0.56	0.54	0.03
Amylbenzene	0.09	0.10	0.08	0.02
n-Hexylbenzene	0.08	0.09	0.1	0.05
BTEX + C₃-benzenes	14.03	12.56	5.66	0.02
All Target BTEX and Alkyl-benzenes	14.85	13.41	6.46	0.11

3.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	MARS TLP Concentration (mg/g oil)			
	0% evap.	8.4% evap.	17.2% evap.	26.2% evap.
<i>n</i> -C ₈	4.66	3.62	0.27	0.00
<i>n</i> -C ₉	4.78	4.48	1.55	0.00
<i>n</i> -C ₁₀	4.41	4.36	2.81	0.01
<i>n</i> -C ₁₁	4.20	4.34	3.73	0.30
<i>n</i> -C ₁₂	3.81	4.06	3.79	1.46
<i>n</i> -C ₁₃	3.44	3.68	3.64	2.69
<i>n</i> -C ₁₄	3.11	3.16	3.20	3.01
<i>n</i> -C ₁₅	2.71	2.92	2.98	3.09
<i>n</i> -C ₁₆	2.15	2.29	2.30	2.60
<i>n</i> -C ₁₇	2.02	2.15	2.20	2.52
Pristane	1.38	1.46	1.51	1.70
<i>n</i> -C ₁₈	1.71	1.80	1.85	2.16
Phytane	1.20	1.25	1.30	1.49
<i>n</i> -C ₁₉	1.33	1.37	1.39	1.55
<i>n</i> -C ₂₀	1.22	1.30	1.36	1.52
<i>n</i> -C ₂₁	0.99	1.06	1.09	1.22
<i>n</i> -C ₂₂	0.85	0.91	0.93	1.03
<i>n</i> -C ₂₃	0.72	0.76	0.82	0.90
<i>n</i> -C ₂₄	0.69	0.71	0.73	0.83
<i>n</i> -C ₂₅	0.66	0.68	0.70	0.77
<i>n</i> -C ₂₆	0.63	0.64	0.66	0.73
<i>n</i> -C ₂₇	0.41	0.43	0.47	0.53
<i>n</i> -C ₂₈	0.39	0.41	0.43	0.47
<i>n</i> -C ₂₉	0.32	0.34	0.37	0.41
<i>n</i> -C ₃₀	0.26	0.27	0.28	0.32
<i>n</i> -C ₃₁	0.24	0.26	0.26	0.30
<i>n</i> -C ₃₂	0.21	0.23	0.25	0.27
<i>n</i> -C ₃₃	0.20	0.21	0.23	0.25
<i>n</i> -C ₃₄	0.18	0.19	0.21	0.22
<i>n</i> -C ₃₅	0.16	0.17	0.20	0.21
<i>n</i> -C ₃₆	0.10	0.12	0.14	0.16
<i>n</i> -C ₃₇	0.06	0.07	0.08	0.09
<i>n</i> -C ₃₈	0.05	0.06	0.07	0.08
<i>n</i> -C ₃₉	0.04	0.05	0.06	0.07
<i>n</i> -C ₄₀	0.04	0.04	0.05	0.05
<i>n</i> -C ₄₁	0.03	0.03	0.04	0.04
<i>n</i> -C ₄₂	0.03	0.03	0.03	0.03
<i>n</i> -C ₄₃	0.01	0.02	0.02	0.02
<i>n</i> -C ₄₄	0.01	0.01	0.01	0.02
TOTAL	49.4	49.9	42	33.1
C ₁₇ /PRISTANE	1.47	1.47	1.46	1.48
C ₁₈ /PHYTANE	1.43	1.44	1.43	1.45
PRISTANE/PHYTANE	1.15	1.17	1.16	1.15
Odd Alkanes	22.3	23.0	19.8	15.0
Even Alkanes	24.5	24.2	19.4	15.0
CPI	0.91	0.95	1.02	1

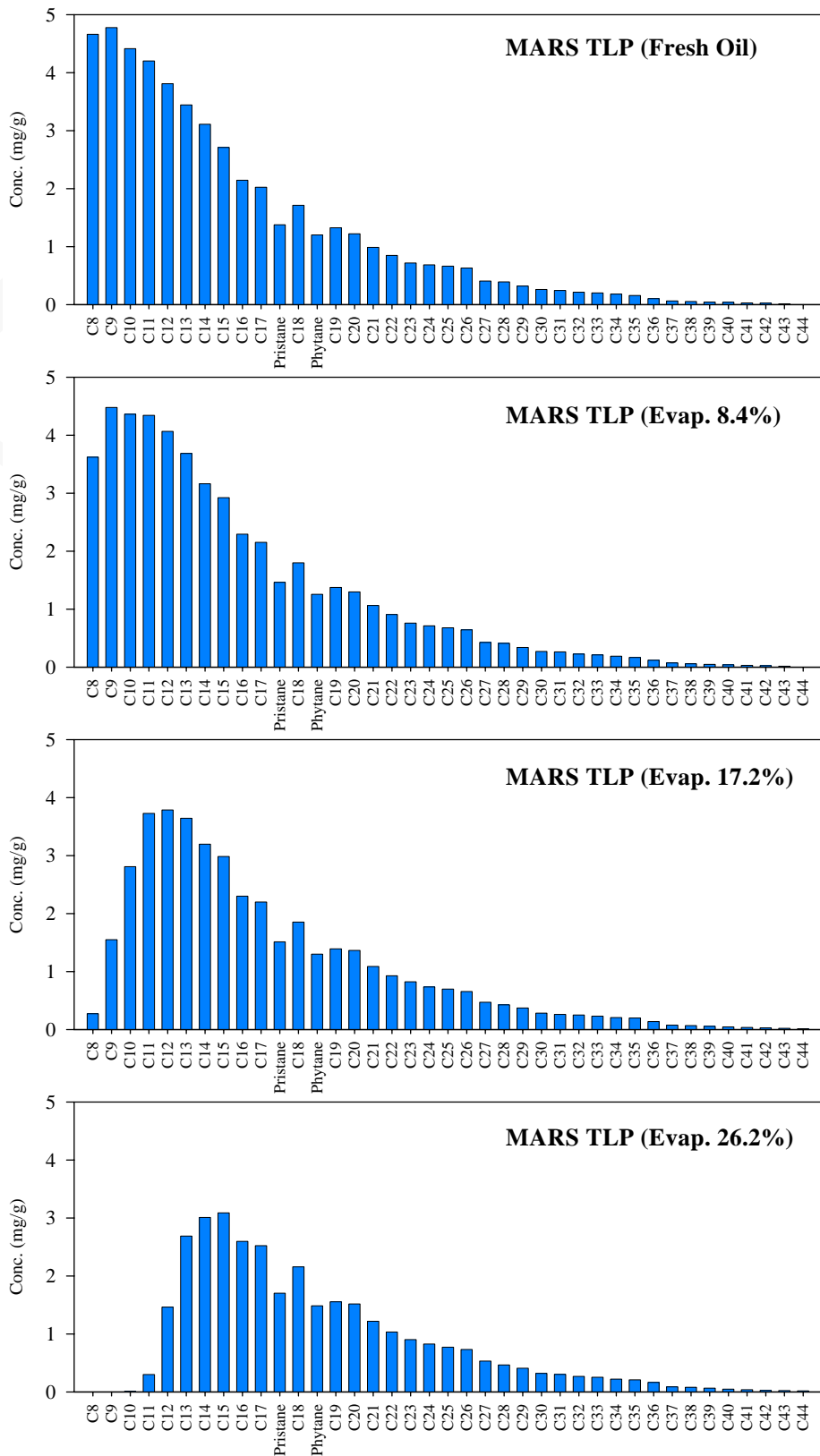


Figure 7 *n*-Alkane Distributions for MARS TLP

3.6 PAH Distributions

		MARS TLP Concentration (µg/g oil)			
Alkylated PAHs		0% evap.	8.4% evap.	17.2% evap.	26.2% evap.
Naphthalene	C0-N	206	207	183	77.5
	C1-N	973	1013	957	847
	C2-N	1802	1870	1881	2066
	C3-N	1914	1985	2078	2300
	C4-N	1246	1339	1422	1562
	Sum	6141	6414	6520	6853
Phenanthrene	C0-P	81.4	85.6	89.2	101
	C1-P	274	292	300	341
	C2-P	406	430	449	497
	C3-P	343	368	395	434
	C4-P	217	232	249	271
	Sum	1321	1407	1482	1644
Dibenzothiophene	C0-D	77.3	81.8	84.5	97.4
	C1-D	258	271	286	325
	C2-D	541	574	604	661
	C3-D	521	558	585	638
	Sum	1396	1485	1560	1722
Fluorene	C0-F	25.8	27.0	29.1	32.7
	C1-F	96.3	103	113	125
	C2-F	206	224	239	263
	C3-F	245	265	278	304
	Sum	573	619	659	726
Chrysene	C0-C	16.8	18.0	19.3	21.4
	C1-C	43.7	47.6	51.7	56.0
	C2-C	71.6	76.8	80.7	90.2
	C3-C	68.3	73.1	77.3	85.3
	Sum	200	216	229	253
Total alkylated PAHs		9631	10142	10449	11198
C2-N/C1-N		1.11	1.13	1.12	1.06
Ratios of C3-D isomers		1.00:0.76:0.61	1.00:0.77:0.60	1.00:0.76:0.60	1.00:0.76:0.59
Ratio of C1-P isomers		1.51	1.49	1.49	1.50
(C2D/C2P):(C3D/C3P)		1.33:1.52	1.34:1.52	1.35:1.48	1.33:1.47
C0N:C1N:C2N:C3N:C4N		0.17:0.78:1.45:1.54:1.00	0.15:0.76:1.40:1.48:1.00	0.13:0.67:1.32:1.46:1.00	0.05:0.54:1.32:1.47:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		4.65:1.00:1.06:0.43:0.15	4.56:1.00:1.06:0.44:0.15	4.40:1.00:1.05:0.44:0.15	4.17:1.00:1.05:0.44:0.15
EPA Priority PAHs					
Biphenyl		29.0	31.8	31.0	30.8
Acenaphthylene		9.89	10.8	11.1	11.8
Acenaphthene		5.78	7.65	8.82	10.5
Anthracene		1.60	1.68	1.78	2.12
Fluoranthene		4.04	4.13	4.44	4.77
Pyrene		3.35	3.62	3.83	4.30
Benz(a)anthracene		1.73	1.81	2.24	2.38
Benzo(b)fluoranthene		1.47	1.51	1.54	1.71
Benzo(k)fluoranthene		0.52	0.53	0.55	0.58
Benzo(e)pyrene		3.92	4.10	4.67	5.28
Benzo(a)pyrene		0.82	0.87	0.93	1.25
Perylene		7.40	8.46	8.51	9.73
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.53	0.56	0.60	0.69
Benzo(ghi)perylene		0.80	0.84	0.87	0.91
Total EPA Priority PAHs		70.8	78.3	80.9	86.8
TOTAL PAHs		9702	10220	10530	11285

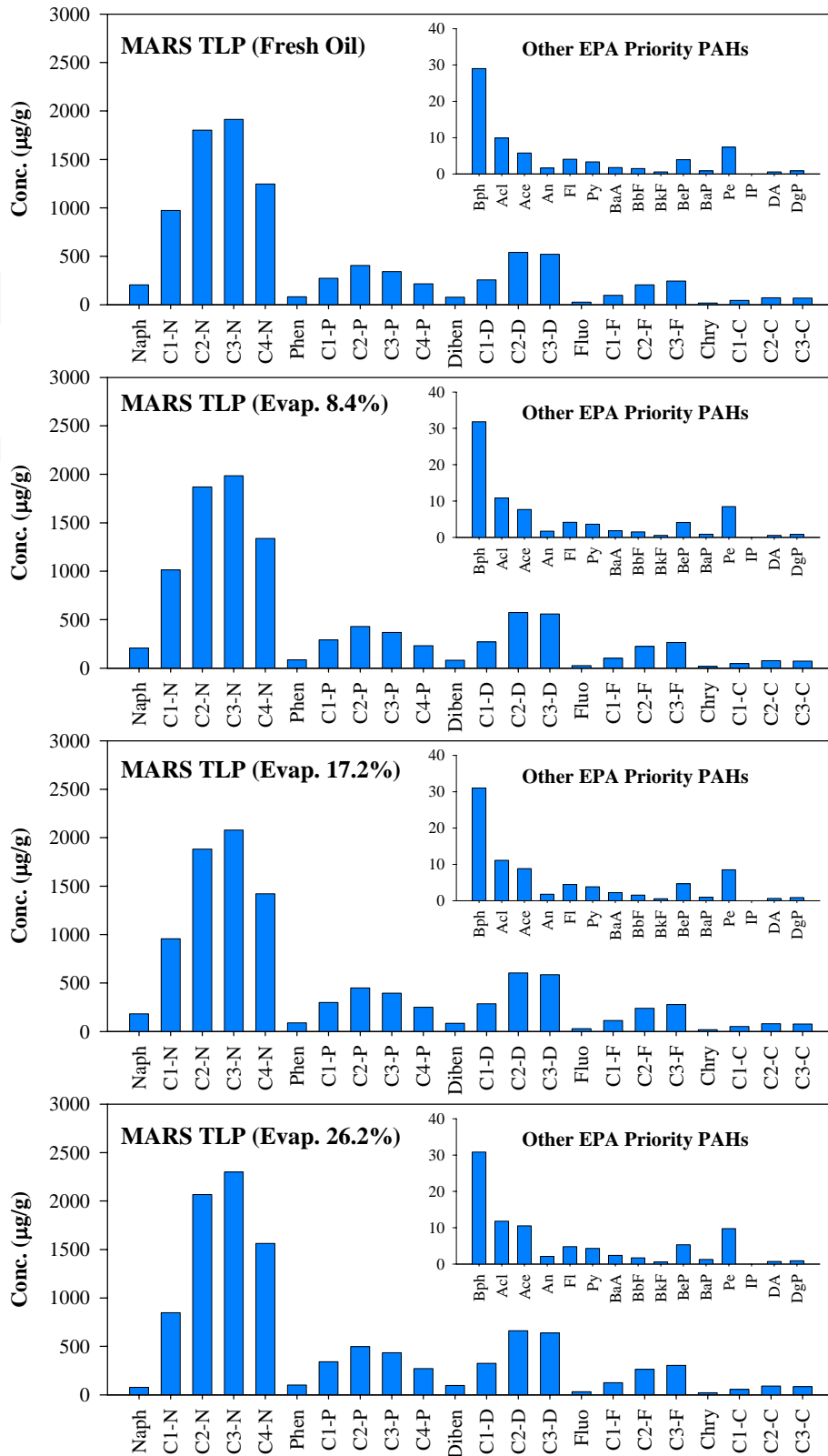


Figure 8 PAH Distributions for MARS TLP

3.7 Biomarker Distributions

MARS TLP				
Concentration ($\mu\text{g/g oil}$)				
Biomarker	0% evap.	8.4% evap.	17.2% evap.	26.2% evap.
C21	6.59	7.43	7.67	9.25
C22	3.20	3.47	3.84	4.52
C23	12.4	12.8	14.7	16.8
C24	8.22	8.48	9.71	11.1
C29 hopane	62.9	66.1	72.6	78.7
C30 hopane	82.8	87.8	97.0	106
C31(S)	42.8	47.0	51.1	57.1
C31(R)	32.1	35.3	38.1	42.3
C32(S)	26.3	29.4	31.7	35.0
C32(R)	17.3	19.4	20.9	23.0
C33(S)	16.9	19.9	20.4	22.7
C33(R)	12.3	14.3	14.5	15.7
C34(S)	10.1	11.7	12.0	13.5
C34(R)	6.64	7.62	7.90	8.55
C35(S)	9.54	10.8	11.4	12.4
C35(R)	7.06	7.82	8.38	8.98
Ts	14.2	15.7	17.0	19.4
Tm	22.6	24.5	26.2	30.3
C27 $\alpha\beta$ steranes	195	210	236	259
C28 $\alpha\beta$ steranes	149	157	175	190
C29 $\alpha\beta$ steranes	203	217	245	266
TOTAL	941	1013	1120	1230
C23/C24	1.51	1.51	1.51	1.51
C23/C30	0.15	0.15	0.15	0.16
C24/C30	0.10	0.10	0.10	0.10
C29/C30	0.76	0.75	0.75	0.74
C31(S)/C31(R)	1.33	1.33	1.34	1.35
C32(S)/C32(R)	1.52	1.52	1.52	1.52
Ts/Tm	0.63	0.64	0.65	0.64
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.96	0.97	0.96	0.97
Σ (C31 to C35) homohopanes	181	203	216	239
C30/ Σ (C31 to C35)	0.46	0.43	0.45	0.44

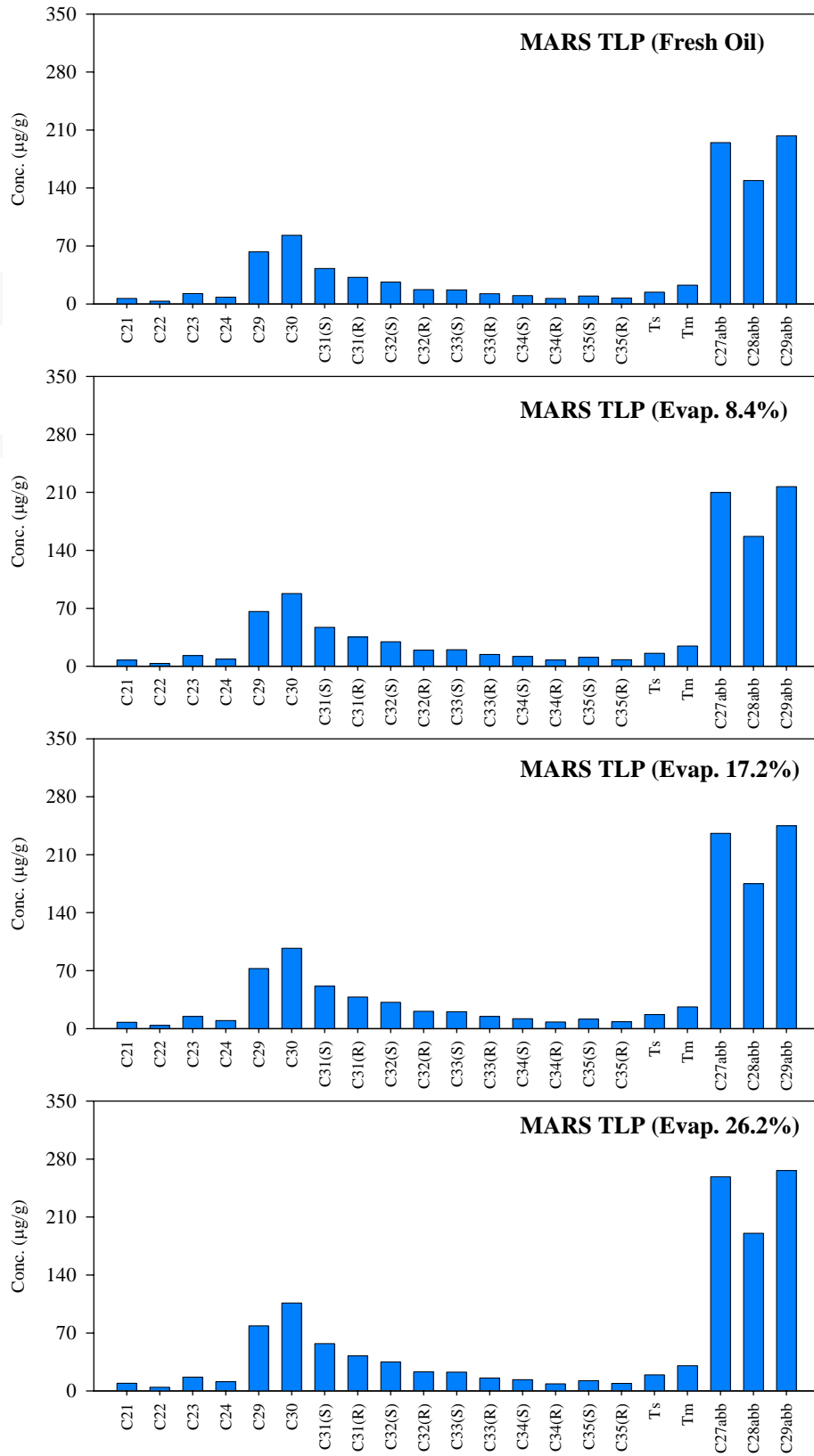


Figure 9 Biomarker Distributions for MARS TLP

4. Maya (2004)

4.1 Origin

Gulf of Mexico, Mexico

4.2 Physical Properties

		Maya (2004) % Evaporative Mass Loss			
		0.0%	5.5%	11.4%	16.7%
Density (g/mL)	5°C	0.9399	0.9577	0.9737	0.9866
	15°C	0.9321	0.9499	0.9662	0.9791
	30°C	0.9219	0.9397	0.956	0.9672
API Gravity		20.2			
Dynamic Viscosity (mPa•s)	5°C	1254	6234	41320	612700*
	15°C	576.7	2080	10990	115000*
	30°C	188.9	570.3	2488	14000
Hydrocarbon Groups (%w/w)	Saturates	46.5%	42.7%	39.2%	35.3%
	Aromatics	25.4%	24.7%	26.0%	24.2%
	Resins	12.7%	15.3%	15.6%	18.8%
	Asphaltenes	15.5%	17.3%	19.2%	21.7%
Surface Tension (mN/m)	5°C	NM	NM	NM	NM
	15°C	28.4	NM	NM	NM
	30°C	28.3	28.8	NM	NM
Interfacial Tension (Oil/Water, mN/m)	5°C	NM	NM	NM	NM
	15°C	30.1	NM	NM	NM
	30°C	27.1	31	NM	NM
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	NM	NM	NM	NM
	15°C	28.4	NM	NM	NM
	30°C	26.7	30.4	NM	NM

Note: All values are the average of a minimum of three measurements.

* Measured statically on the RS-300 Rheometer.

4.3 GC-TPH Distributions

Fraction	Maya (2004) Concentration (mg/g oil)			
	0% evap.	5.5% evap.	11.4% evap.	16.7% evap.
Total GC-TPH [†]	474	476	464	456
GC-Saturates/GC-TPH [†]	64.7%	63.3%	60.1%	59.2%
GC-Aromatics/GC-TPH [†]	35.3%	36.7%	39.9%	40.8%
Resolved Peaks/GC-TPH	22.2%	20.7%	19.0%	17.0%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈₋ ≤ to ≤ <i>n</i> -C ₁₀	44.2	36.3	11.7	1.73
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	118	119	116	94.5
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	259	268	282	306
<i>n</i> -C ₃₄ +	52.8	53.1	53.8	53.7

[†]Including both resolved peaks and unresolved complex mixture areas.

4.4 BTEX and Alkyl-benzene Distributions

	Maya (2004) Concentration (mg/g oil)			
	0% evap.	5.5% evap.	11.4% evap.	16.7% evap.
Benzene	0.75	0.13	0.00	0.00
Toluene	2.78	1.36	0.01	0.00
Ethylbenzene	1.06	0.78	0.09	0.00
<i>meta</i> - and <i>para</i> -Xylene	2.48	1.92	0.31	0.00
<i>ortho</i> -Xylene	1.26	1.03	0.24	0.00
Sum BTEX	8.34	5.21	0.65	0.00
Isopropylbenzene	0.19	0.16	0.05	0.00
Propylbenzene	0.41	0.34	0.15	0.00
3- and 4-Ethyltoluene	1.43	1.27	0.53	0.01
1,3,5-Trimethylbenzene	0.57	0.52	0.28	0.01
2-Ethyltoluene	0.80	0.72	0.38	0.01
1,2,4-Trimethylbenzene	1.46	1.35	0.82	0.04
1,2,3-Trimethylbenzene	0.12	0.11	0.07	0.00
Sum C₃-benzenes	4.97	4.47	2.28	0.07
Isobutylbenzene	0.03	0.02	0.02	0.00
1-Methyl-2-isopropylbenzene	0.04	0.04	0.02	0.00
1,2-Dimethyl-4-ethylbenzene	0.39	0.37	0.31	0.07
Amylbenzene	0.07	0.07	0.07	0.03
<i>n</i> -Hexylbenzene	0.06	0.06	0.06	0.05
BTEX + C₃-benzenes	13.31	9.68	2.93	0.07
All Target BTEX and Alkyl-benzenes	13.90	10.25	3.41	0.23

4.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	Maya (2004) Concentration (mg/g oil)			
	0% evap.	5.5% evap.	11.4% evap.	16.7% evap.
<i>n</i> -C ₈	4.08	2.58	0.08	0
<i>n</i> -C ₉	4.73	4.04	0.86	0
<i>n</i> -C ₁₀	4.66	4.23	2.5	0.08
<i>n</i> -C ₁₁	4.59	4.55	3.86	1.05
<i>n</i> -C ₁₂	4.23	4.34	4.33	2.72
<i>n</i> -C ₁₃	3.95	4.18	4.53	3.87
<i>n</i> -C ₁₄	3.85	4.11	4.4	4.23
<i>n</i> -C ₁₅	3.66	3.8	4	4.16
<i>n</i> -C ₁₆	3.18	3.32	3.49	3.64
<i>n</i> -C ₁₇	3.07	3.21	3.42	3.63
Pristane	0.99	1.03	1.08	1.17
<i>n</i> -C ₁₈	2.67	2.78	2.94	3.15
Phytane	1.45	1.5	1.59	1.72
<i>n</i> -C ₁₉	2.14	2.19	2.33	2.53
<i>n</i> -C ₂₀	2.08	2.16	2.25	2.39
<i>n</i> -C ₂₁	1.69	1.75	1.88	1.97
<i>n</i> -C ₂₂	1.49	1.55	1.67	1.81
<i>n</i> -C ₂₃	1.3	1.32	1.45	1.54
<i>n</i> -C ₂₄	1.2	1.21	1.33	1.39
<i>n</i> -C ₂₅	1.07	1.1	1.19	1.24
<i>n</i> -C ₂₆	1.05	1.08	1.13	1.2
<i>n</i> -C ₂₇	0.73	0.77	0.8	0.88
<i>n</i> -C ₂₈	0.61	0.64	0.69	0.75
<i>n</i> -C ₂₉	0.58	0.6	0.63	0.69
<i>n</i> -C ₃₀	0.49	0.51	0.54	0.6
<i>n</i> -C ₃₁	0.46	0.49	0.52	0.55
<i>n</i> -C ₃₂	0.37	0.39	0.43	0.47
<i>n</i> -C ₃₃	0.35	0.36	0.4	0.43
<i>n</i> -C ₃₄	0.28	0.29	0.33	0.35
<i>n</i> -C ₃₅	0.27	0.28	0.3	0.32
<i>n</i> -C ₃₆	0.15	0.16	0.18	0.2
<i>n</i> -C ₃₇	0.12	0.12	0.12	0.13
<i>n</i> -C ₃₈	0.1	0.1	0.11	0.12
<i>n</i> -C ₃₉	0.06	0.07	0.08	0.09
<i>n</i> -C ₄₀	0.05	0.06	0.07	0.08
<i>n</i> -C ₄₁	0.03	0.04	0.05	0.06
<i>n</i> -C ₄₂	0.02	0.03	0.04	0.05
<i>n</i> -C ₄₃	0.02	0.02	0.02	0.03
<i>n</i> -C ₄₄	0.01	0.02	0.01	0.02
TOTAL	61.8	61.0	55.6	49.3
C ₁₇ /PRISTANE	3.12	3.13	3.15	3.11
C ₁₈ /PHYTANE	1.84	1.85	1.85	1.83
PRISTANE/PHYTANE	0.68	0.68	0.68	0.68
Odd Alkanes	28.8	28.9	26.4	23.2
Even Alkanes	30.6	29.6	26.5	23.3
CPI	0.94	0.98	1	1

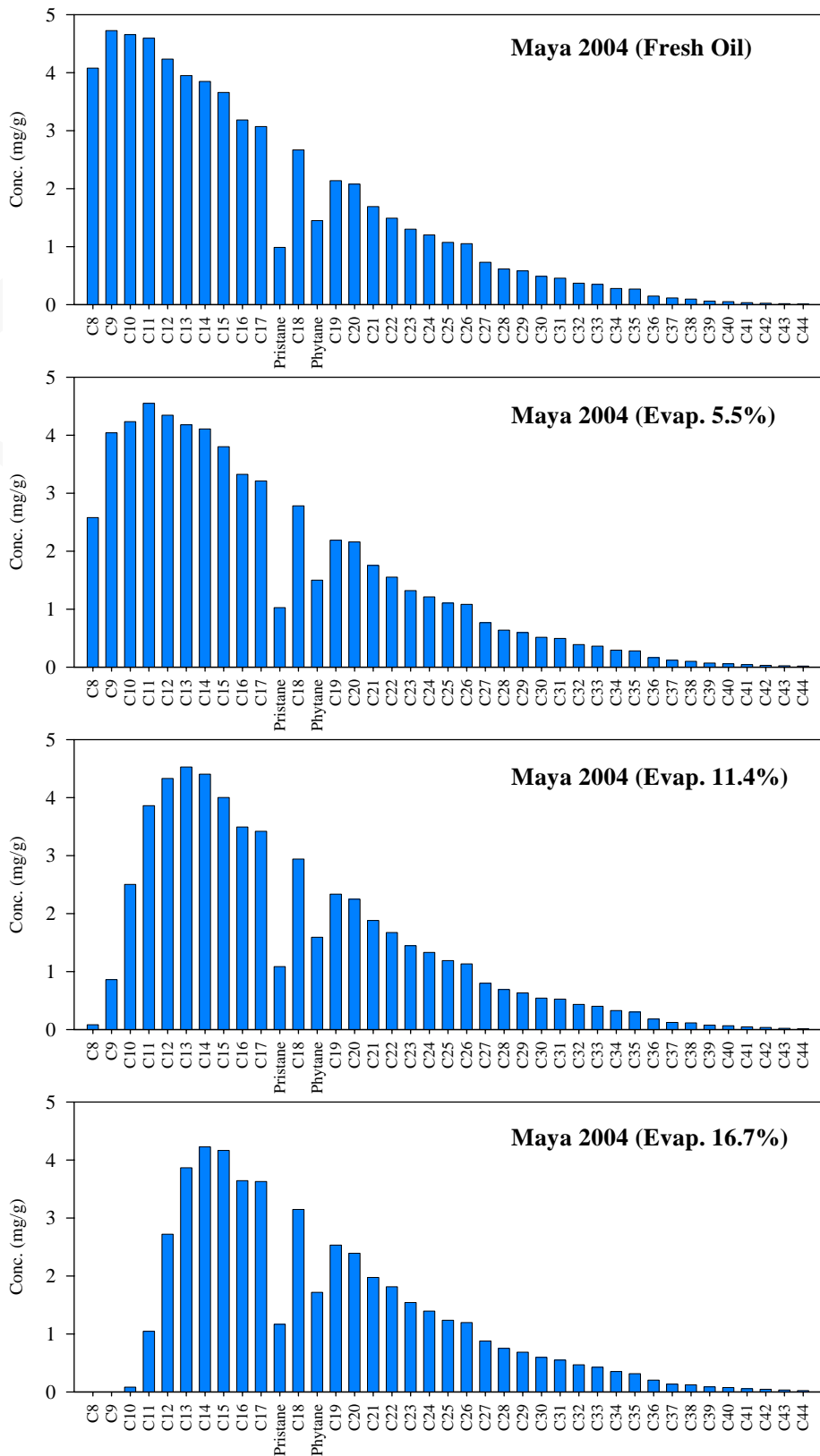


Figure 10 *n*-Alkane Distributions for Maya (2004)

4.6 PAH Distributions

		Maya (2004) Concentration (µg/g oil)			
Alkylated PAHs		0% evap.	5.5% evap.	11.4% evap.	16.7% evap.
Naphthalene	C0-N	187	196	206	121
	C1-N	851	873	978	842
	C2-N	1444	1501	1695	1645
	C3-N	1331	1396	1519	1589
	C4-N	784	828	901	938
	Sum	4597	4794	5300	5134
Phenanthrene	C0-P	82.3	89.2	94.9	98.8
	C1-P	251	268	287	311
	C2-P	339	358	383	413
	C3-P	265	273	285	318
	C4-P	167	205	239	250
	Sum	1105	1194	1289	1391
Dibenzothiophene	C0-D	155	166	180	193
	C1-D	437	462	498	538
	C2-D	783	832	897	965
	C3-D	657	688	752	813
	Sum	2032	2148	2326	2509
Fluorene	C0-F	38.9	40.7	44.8	46.6
	C1-F	119	125	136	143
	C2-F	221	237	251	267
	C3-F	267	289	299	326
	Sum	646	693	730	783
Chrysene	C0-C	19.2	20.5	22.0	24.1
	C1-C	43.1	46.5	49.3	53.0
	C2-C	67.7	73.6	78.3	85.5
	C3-C	65.5	70.5	73.6	79.9
	Sum	196	211	223	242
Total alkylated PAHs		8575	9040	9869	10059
C2-N/C1-N		1.18	1.18	1.17	1.14
Ratios of C3-D isomers		1.00:0.75:0.53	1.00:0.77:0.54	1.00:0.76:0.53	1.00:0.76:0.53
Ratio of C1-P isomers		1.24	1.25	1.24	1.25
(C2D/C2P):(C3D/C3P)		2.31:2.48	2.32:2.52	2.34:2.64	2.34:2.55
C0N:C1N:C2N:C3N:C4N		0.24:1.09:1.84:1.70:1.00	0.24:1.05:1.81:1.69:1.00	0.23:1.09:1.88:1.69:1.00	0.13:0.90:1.75:1.69:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		4.16:1.00:1.84:0.58:0.18	4.02:1.00:1.80:0.58:0.18	4.11:1.00:1.81:0.57:0.17	3.69:1.00:1.80:0.56:0.17
EPA Priority PAHs					
Biphenyl		13.7	14.4	16.0	15.8
Acenaphthylene		8.74	9.19	10.3	10.2
Acenaphthene		6.22	6.85	9.73	7.71
Anthracene		2.17	2.24	2.51	2.74
Fluoranthene		2.71	2.84	3.33	3.82
Pyrene		4.87	5.47	5.58	6.27
Benz(a)anthracene		1.02	1.37	1.54	1.98
Benzo(b)fluoranthene		2.46	2.73	2.88	2.96
Benzo(k)fluoranthene		0.19	0.32	0.45	0.50
Benzo(e)pyrene		7.08	7.39	7.63	8.19
Benzo(a)pyrene		0.93	1.16	1.25	1.32
Perylene		0.45	0.56	0.60	0.69
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.44	0.52	0.55	0.58
Benzo(ghi)perylene		1.46	1.60	1.71	1.84
Total EPA Priority PAHs		52.5	56.6	64.1	64.6
TOTAL PAHs		8628	9097	9933	10124

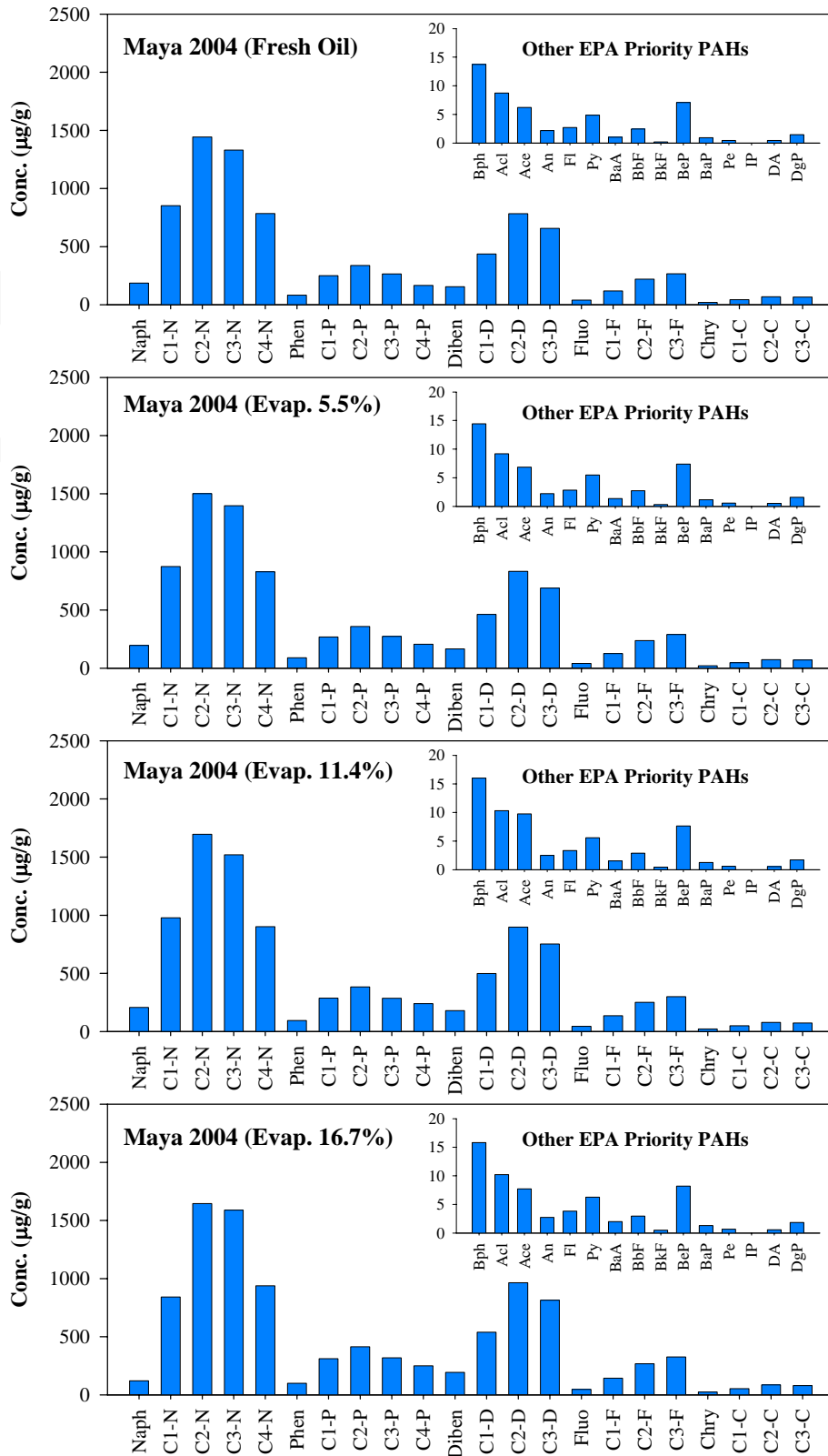


Figure 11 PAH Distributions for Maya (2004)

4.7 Biomarker Distributions

Maya (2004)				
Concentration ($\mu\text{g/g oil}$)				
Biomarker	0% evap.	5.5% evap.	11.4% evap.	16.7% evap.
C21	6.82	7.08	7.69	8.29
C22	4.64	4.97	5.07	5.21
C23	21.7	22.3	24.4	25.5
C24	8.98	9.13	9.67	11.3
C29 hopane	109	113	123	129
C30 hopane	105	109	117	124
C31(S)	60.8	64.2	68.0	72.2
C31(R)	45.2	47.2	49.6	52.9
C32(S)	34.3	36.3	38.8	41.6
C32(R)	22.6	23.8	26.0	27.6
C33(S)	23.1	23.9	24.3	26.3
C33(R)	15.5	16.1	16.4	17.8
C34(S)	14.6	15.5	16.2	17.1
C34(R)	9.12	9.59	9.88	10.6
C35(S)	14.4	15.9	16.2	17.5
C35(R)	8.36	9.38	9.50	10.2
Ts	12.7	13.6	14.2	15.6
Tm	36.7	38.7	39.1	44.2
C27 $\alpha\beta$ steranes	191	205	220	230
C28 $\alpha\beta$ steranes	148	159	179	186
C29 $\alpha\beta$ steranes	216	233	244	257
TOTAL	1108	1177	1259	1330
C23/C24	2.41	2.44	2.52	2.26
C23/C30	0.21	0.21	0.21	0.21
C24/C30	0.09	0.08	0.08	0.09
C29/C30	1.04	1.04	1.05	1.04
C31(S)/C31(R)	1.34	1.36	1.37	1.36
C32(S)/C32(R)	1.52	1.52	1.49	1.51
Ts/Tm	0.35	0.35	0.36	0.35
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.88	0.88	0.90	0.89
Σ (C31 to C35) homohopanes	248	262	275	294
C30/ Σ (C31 to C35)	0.42	0.41	0.43	0.42

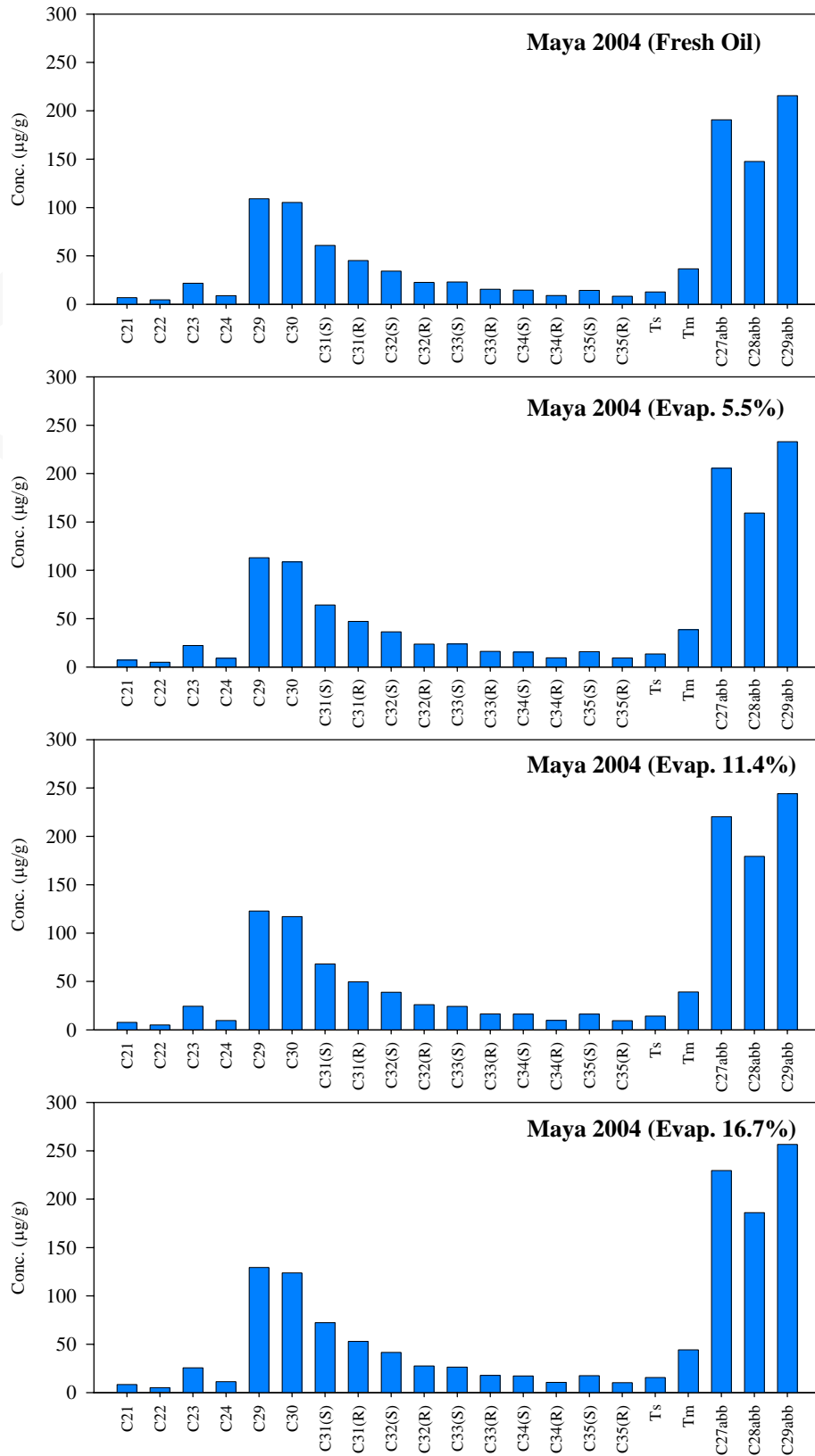


Figure 12 Biomarker Distributions for Maya (2004)

5. Platform Elly

5.1 Origin

California, USA

5.2 Physical Properties

		Platform Elly % Evaporative Mass Loss			
		0.0%	4.6%	7.9%	13.3%
Density (g/mL)	5°C	0.9665	0.9793	0.9862	NM
	15°C	0.9608	0.9732	0.9801	NM
	30°C	0.9513	0.9634	0.9701	0.9843
API Gravity		15.7			
Dynamic Viscosity (mPa•s)	5°C	11377	40103	104333	1676000
	15°C	3860	13348	34193	382333
	30°C	1070	3058	6725	52283
Hydrocarbon Groups (%w/w)	Saturates	34.6%	31.4%	28.8%	25.8%
	Aromatics	32.4%	32.6%	31.1%	31.5%
	Resins	19.4%	21.1%	23.7%	22.9%
	Asphaltenes	13.6%	14.9%	16.4%	19.8%
Surface Tension (mN/m)	5°C	NM	NM	NM	NM
	15°C	NM	NM	NM	NM
	30°C	NM	NM	NM	NM
Interfacial Tension (Oil/Water, mN/m)	5°C	NM	NM	NM	NM
	15°C	NM	NM	NM	NM
	30°C	NM	NM	NM	NM
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	NM	NM	NM	NM
	15°C	NM	NM	NM	NM
	30°C	NM	NM	NM	NM

NM — Not Measured (too viscous)

Note: All values are the average of a minimum of three measurements.

5.3 GC-TPH Distributions

Fraction	Platform Elly Concentration (mg/g oil)			
	0% evap.	4.6% evap.	7.9% evap.	13.3% evap.
Total GC-TPH [†]	436	438	439	410
GC-Saturates/GC-TPH [†]	51.8%	48.5%	48.0%	45.1%
GC-Aromatics/GC-TPH [†]	48.2%	51.5%	52.0%	54.9%
Resolved Peaks/GC-TPH	13.0%	13.6%	12.2%	10.6%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈ - ≤ to ≤ <i>n</i> -C ₁₀	23	21.5	13.6	0.5
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	79	84.3	77.6	66.8
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	252	260	265	261
<i>n</i> -C ₃₄ +	81.3	72.6	82.7	81.3

[†]Including both resolved peaks and unresolved complex mixture areas.

5.4 BTEX and Alkyl-benzene Distributions

	Platform Elly Concentration (mg/g oil)			
	0% evap.	4.6% evap.	7.9% evap.	13.3% evap.
Benzene	0.16	0.05	0.00	0.00
Toluene	0.82	0.45	0.15	0.00
Ethylbenzene	0.50	0.38	0.24	0.00
<i>meta</i> - and <i>para</i> -Xylene	0.74	0.58	0.37	0.00
<i>ortho</i> -Xylene	0.55	0.45	0.30	0.00
Sum BTEX	2.77	1.91	1.07	0
Isopropylbenzene	0.18	0.15	0.11	0.00
Propylbenzene	0.39	0.34	0.26	0.00
3- and 4-Ethyltoluene	0.56	0.50	0.41	0.01
1,3,5-Trimethylbenzene	0.19	0.17	0.14	0.00
2-Ethyltoluene	0.35	0.32	0.27	0.01
1,2,4-Trimethylbenzene	0.53	0.49	0.43	0.03
1,2,3-Trimethylbenzene	0.14	0.13	0.12	0.01
Sum C₃-benzenes	2.34	2.11	1.74	0.06
Isobutylbenzene	0.02	0.02	0.02	0
1-Methyl-2-isopropylbenzene	0.02	0.02	0.02	0
1,2-Dimethyl-4-ethylbenzene	0.17	0.16	0.16	0.04
Amylbenzene	0.08	0.06	0.07	0.03
n-Hexylbenzene	0.06	0.05	0.06	0.04
BTEX + C₃-benzenes	5.1	4.02	2.8	0.06
All Target BTEX and Alkyl-benzenes	5.46	4.34	3.12	0.18

5.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	Platform Elly Concentration (mg/g oil)			
	0% evap.	4.6% evap.	7.9% evap.	13.3% evap.
<i>n</i> -C ₈	0.92	0.53	0.11	0
<i>n</i> -C ₉	0.63	0.41	0.15	0
<i>n</i> -C ₁₀	0.55	0.51	0.29	0
<i>n</i> -C ₁₁	0.66	0.65	0.61	0.13
<i>n</i> -C ₁₂	0.56	0.59	0.54	0.27
<i>n</i> -C ₁₃	0.63	0.63	0.63	0.47
<i>n</i> -C ₁₄	0.72	0.79	0.71	0.66
<i>n</i> -C ₁₅	0.9	0.9	0.91	0.92
<i>n</i> -C ₁₆	0.84	0.94	0.83	0.88
<i>n</i> -C ₁₇	0.88	0.94	0.95	0.97
Pristane	2.18	2.26	2.29	2.42
<i>n</i> -C ₁₈	0.87	0.91	0.97	1.01
Phytane	2.09	2.16	2.25	2.29
<i>n</i> -C ₁₉	0.7	0.74	0.75	0.76
<i>n</i> -C ₂₀	0.77	0.78	0.79	0.81
<i>n</i> -C ₂₁	0.76	0.77	0.78	0.8
<i>n</i> -C ₂₂	0.69	0.73	0.75	0.75
<i>n</i> -C ₂₃	0.66	0.65	0.68	0.69
<i>n</i> -C ₂₄	0.71	0.73	0.78	0.79
<i>n</i> -C ₂₅	0.52	0.52	0.52	0.54
<i>n</i> -C ₂₆	0.4	0.41	0.42	0.43
<i>n</i> -C ₂₇	0.27	0.29	0.29	0.3
<i>n</i> -C ₂₈	0.28	0.31	0.34	0.33
<i>n</i> -C ₂₉	0.33	0.34	0.36	0.36
<i>n</i> -C ₃₀	0.22	0.24	0.25	0.24
<i>n</i> -C ₃₁	0.31	0.31	0.3	0.33
<i>n</i> -C ₃₂	0.12	0.12	0.14	0.15
<i>n</i> -C ₃₃	0.15	0.16	0.19	0.2
<i>n</i> -C ₃₄	0.39	0.39	0.41	0.43
<i>n</i> -C ₃₅	0.57	0.59	0.6	0.64
<i>n</i> -C ₃₆	0.49	0.54	0.53	0.55
<i>n</i> -C ₃₇	0.35	0.35	0.36	0.38
<i>n</i> -C ₃₈	0.25	0.28	0.29	0.31
<i>n</i> -C ₃₉	0.03	0.03	0.04	0.04
<i>n</i> -C ₄₀	0.03	0.04	0.04	0.05
<i>n</i> -C ₄₁	0.04	0.05	0.05	0.05
<i>n</i> -C ₄₂	0.03	0.03	0.03	0.03
<i>n</i> -C ₄₃	0.03	0.03	0.03	0.03
<i>n</i> -C ₄₄	0	0.01	0.02	0.03
TOTAL	21.5	21.7	21.0	20.0
C ₁₇ /PRISTANE	0.4	0.42	0.41	0.4
C ₁₈ /PHYTANE	0.42	0.42	0.43	0.44
PRISTANE/PHYTANE	1.05	1.05	1.02	1.05
Odd Alkanes	8.43	8.36	8.21	7.61
Even Alkanes	8.83	8.89	8.23	7.73
CPI	0.95	0.94	1	0.98

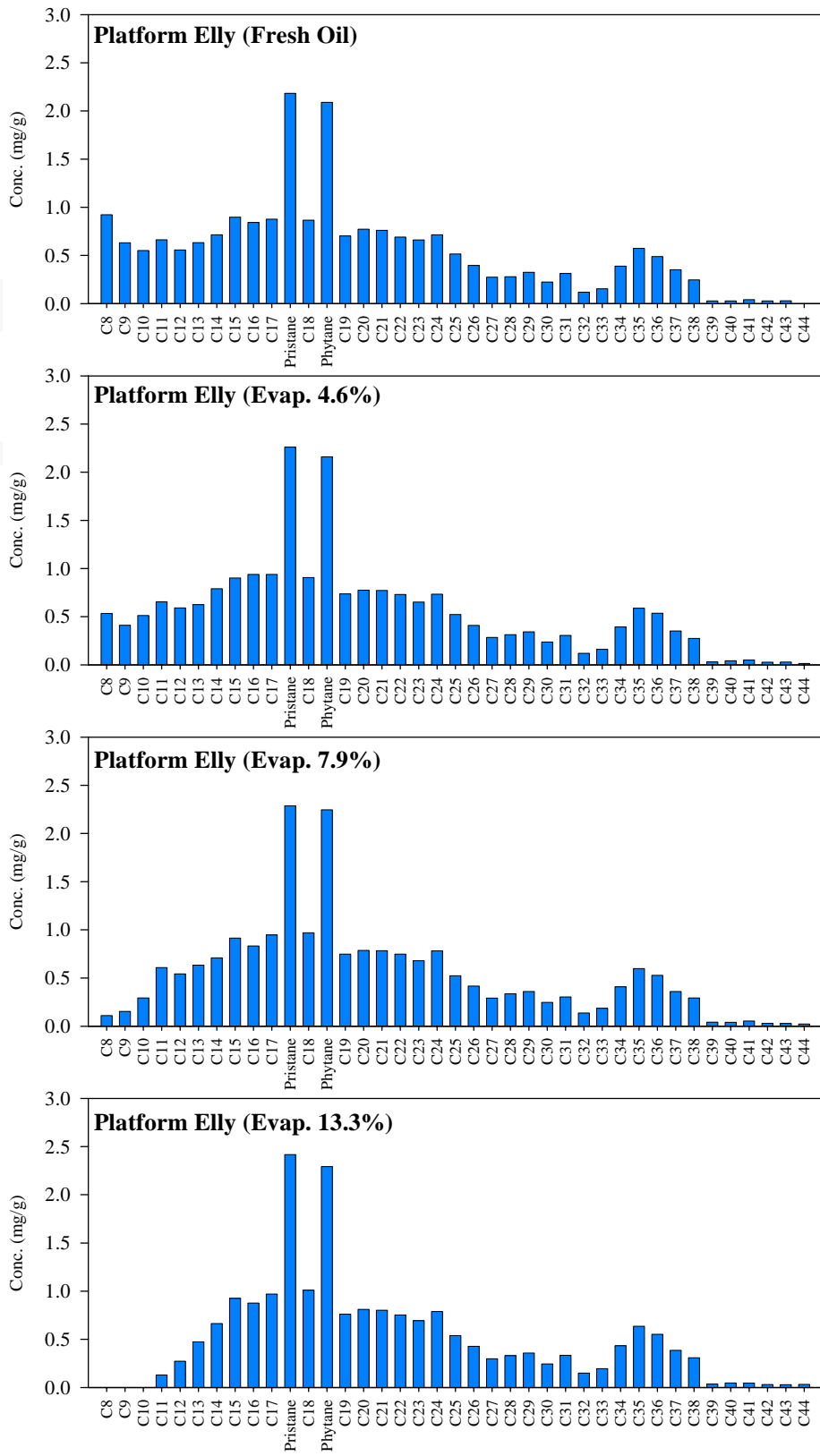


Figure 13 *n*-Alkane Distributions for Platform Elly

5.6 PAH Distributions

		Platform Elly Concentration ($\mu\text{g/g}$ oil)			
		0% evap.	4.6% evap.	7.9% evap.	13.3% evap.
Alkylated PAHs					
Naphthalene	C0-N	85.8	87.0	84.1	52.4
	C1-N	377	378	367	349
	C2-N	744	759	769	836
	C3-N	882	911	928	1058
	C4-N	820	856	903	962
	Sum	2909	2991	3051	3258
Phenanthrene	C0-P	27.3	28.5	28.9	31.5
	C1-P	91.4	92.0	97.9	106
	C2-P	137	143	151	157
	C3-P	109	116	130	135
	C4-P	95.6	108.1	115	121
	Sum	460	487	523	551
Dibenzothiophene	C0-D	47.4	46.4	47.7	52.1
	C1-D	115	124	127	137
	C2-D	212	221	227	241
	C3-D	187	197	205	216
	Sum	561	588	607	647
Fluorene	C0-F	10.2	10.9	11.9	12.5
	C1-F	38.5	44.3	46.2	49.0
	C2-F	80.5	83.5	88.2	92.2
	C3-F	78.7	82.2	90.3	95
	Sum	208	221	237	248
Chrysene	C0-C	10.5	11.0	11.6	12.1
	C1-C	19.7	21.2	22.9	23.9
	C2-C	33.0	34.9	36.7	37.7
	C3-C	24.4	25.8	27.8	29.2
	Sum	87.6	92.8	99.0	102.9
Total alkylated PAHs		4226	4379	4516	4806
C2-N/C1-N		1.36	1.32	1.34	1.37
Ratios of C3-D isomers		1.00:0.71:0.67	1.00:0.71:0.68	1.00:0.70:0.67	1.00:0.71:0.66
Ratios of C2-P isomers (C2D/C2P):(C3D/C3P)		1.00	0.98	1.00	1.01
C0N:C1N:C2N:C3N:C4N		0.10:0.46:0.91:1.08:1.00	0.10:0.44:0.89:1.07:1.00	0.09:0.41:0.85:1.03:1.00	0.05:0.36:0.87:1.10:1.00
$\sum\text{N}:\sum\text{P}:\sum\text{DBT}:\sum\text{F}:\sum\text{C}$		6.32:1.00:1.22:0.45:0.19	6.15:1.00:1.21:0.45:0.19	5.83:1.00:1.16:0.45:0.19	5.92:1.00:1.17:0.45:0.19
EPA Priority PAHs					
Biphenyl		5.77	6.44	6.69	6.18
Acenaphthylene		8.56	9.24	9.66	10.2
Acenaphthene		6.01	6.32	6.51	6.87
Anthracene		0.60	0.82	0.78	0.96
Fluoranthene		1.57	1.32	1.64	1.99
Pyrene		3.81	4.20	4.53	4.61
Benz(a)anthracene		2.43	2.81	3.30	3.48
Benzo(b)fluoranthene		2.87	3.72	3.92	4.19
Benzo(k)fluoranthene		0.00	0.00	0.00	0.00
Benzo(e)pyrene		3.55	4.47	4.67	5.31
Benzo(a)pyrene		1.32	1.36	1.46	1.75
Perylene		30.2	29.9	31.2	35.7
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.00	0.00	0.00	0.00
Benzo(ghi)perylene		1.48	1.65	1.87	1.99
Total EPA Priority PAHs		68.1	72.2	76.2	83.2
TOTAL PAHs		4294	4452	4593	4889

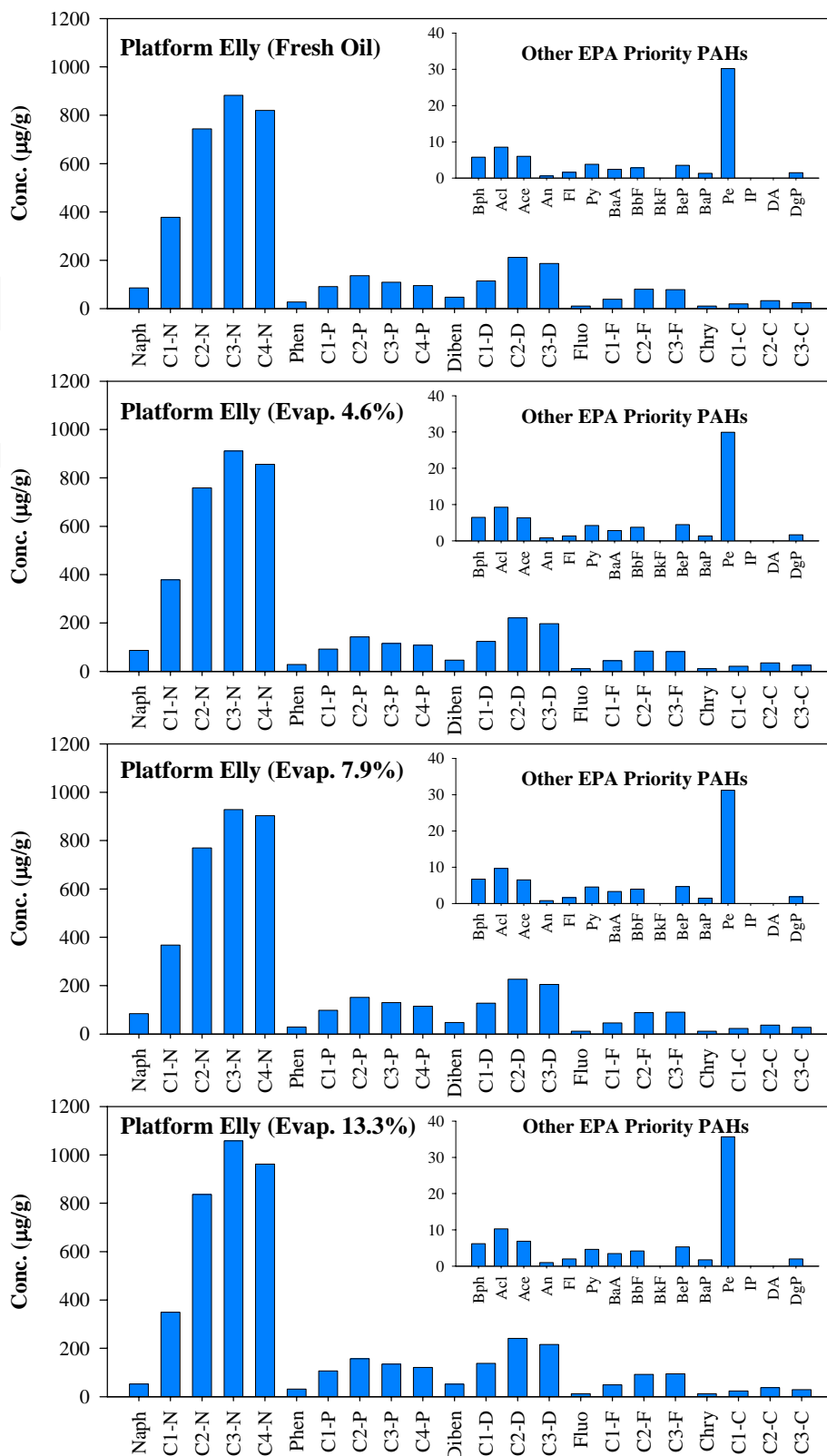


Figure 14 PAH Distributions for Platform Elly

5.7 Biomarker Distributions

Biomarker	Platform Elly Concentration ($\mu\text{g/g oil}$)			
	0% evap.	4.6% evap.	7.9% evap.	13.3% evap.
C21	20.1	20.9	22.0	21.5
C22	4.32	4.32	4.90	4.82
C23	41.3	42.3	43.6	44.8
C24	33.9	34.8	35.4	37.0
C29 hopane	107	113	119	125
C30 hopane	216	224	229	241
C31(S)	64.6	66.4	68.6	70.7
C31(R)	52.5	53.7	54.5	56.6
C32(S)	43.0	44.0	45.5	47.6
C32(R)	32.2	32.7	33.6	34.4
C33(S)	35.2	35.9	37.5	39.3
C33(R)	28.5	29.0	30.4	31.7
C34(S)	20.0	21.2	21.6	22.8
C34(R)	15.1	15.6	15.8	16.2
C35(S)	22.1	22.4	24.6	26.7
C35(R)	20.9	21.5	20.8	22.7
Ts	13.2	13.4	14.2	14.9
Tm	55.9	56.6	57.2	59.1
C27 $\alpha\beta$ steranes	649	666	696	712
C28 $\alpha\beta$ steranes	754	780	816	845
C29 $\alpha\beta$ steranes	466	475	495	522
TOTAL	2695	2773	2885	2996
C23/C24	1.22	1.22	1.23	1.21
C23/C30	0.19	0.19	0.19	0.19
C24/C30	0.16	0.16	0.15	0.15
C29/C30	0.49	0.50	0.52	0.52
C31(S)/C31(R)	1.23	1.24	1.26	1.25
C32(S)/C32(R)	1.33	1.34	1.35	1.39
Ts/Tm	0.24	0.24	0.25	0.25
C27 $\alpha\beta$ /C29 $\alpha\beta$	1.39	1.40	1.41	1.36
Σ (C31 to C35) homohopanes	334	342	353	369
C30/ Σ (C31 to C35)	0.65	0.65	0.65	0.65

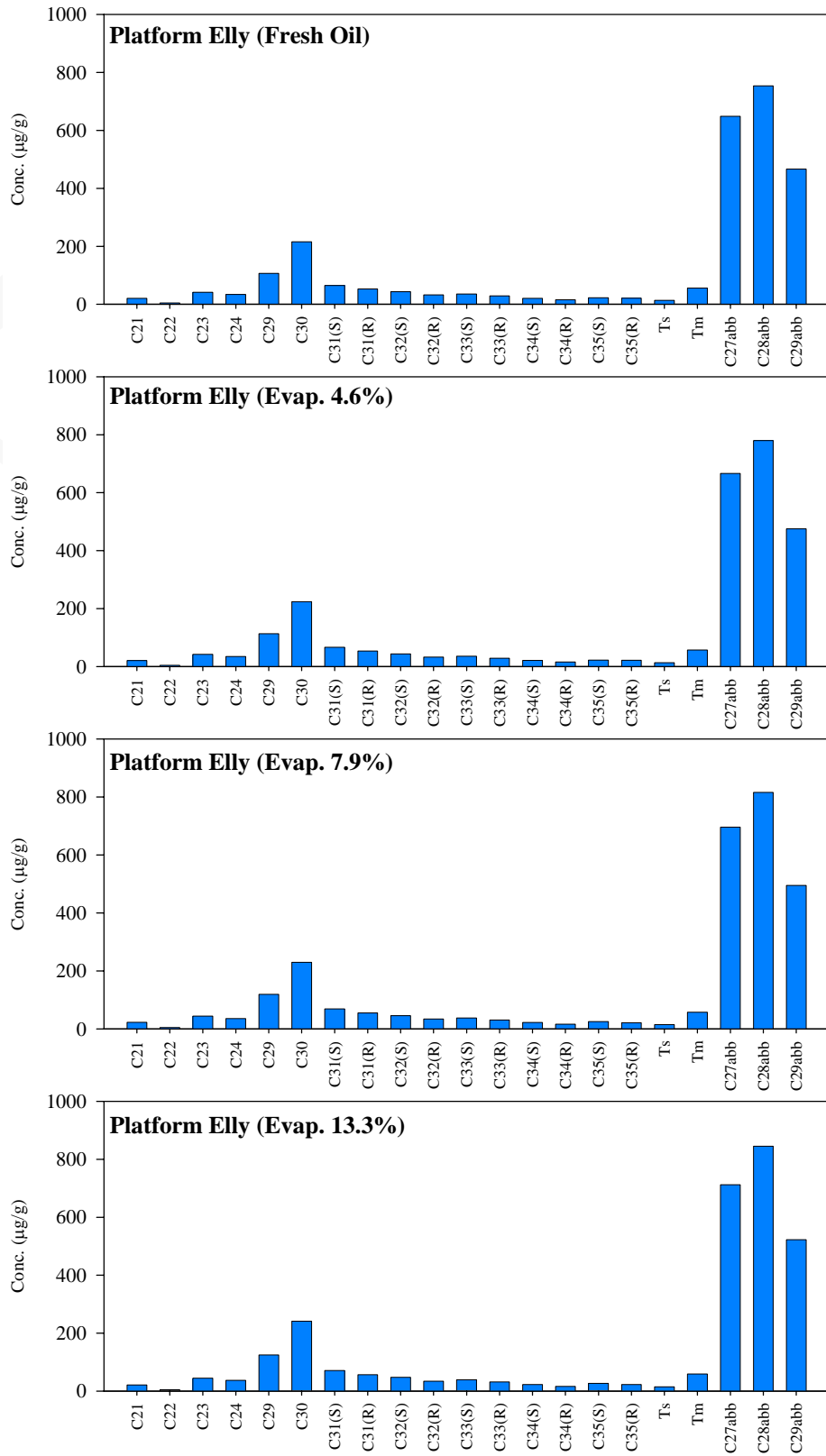


Figure 15 Biomarker Distributions for Platform Elly

6. Prudhoe Bay (USEPA Reference Standard) [2004]

6.1 Origin

Alaska, U.S.A.

6.2 Physical Properties

		Prudhoe Bay (USEPA Reference Standard) [2004]			
		% Evaporative Mass Loss			
		0.0%	6.3%	13.1%	19.7%
Density (g/mL)	5°C	0.9026	0.9190	0.9313	0.9413
	15°C	0.8947	0.9112	0.9235	0.9336
	30°C	0.8842	0.9006	0.9131	0.9233
API Gravity		26.6			
Dynamic Viscosity (mPa•s)	5°C	78.7	300.8	3302 ^a	10520 ^a
				1571 ^b	4510 ^b
				840 ^c	2155 ^c
	15°C	38.9	102.8	318.4	864.7
	30°C	21.7	41.7	93.4	203.1
Hydrocarbon Groups (%w/w)	Saturates	60.8%	60.4%	58.5%	53.9%
	Aromatics	28.3%	27.7%	27.0%	25.2%
	Resins	7.7%	8.2%	10.1%	15.7%
	Asphaltenes	3.2%	3.8%	4.4%	5.2%
Surface Tension (mN/m)	5°C	29.2	30.2	NM	NM
	15°C	28.7	29.8	30.8	NM
	30°C	27.5	27.5	28.9	29.8
Interfacial Tension (Oil/Water, mN/m)	5°C	28.6	19.0	NM	NM
	15°C	31.3	25.2	24.5	NM
	30°C	27.3	24.9	22.3	19.6
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	29.2	17.5	NM	NM
	15°C	28.1	23.8	22.4	NM
	30°C	25.1	26.4	22.8	19.8

Note: All values are the average of a minimum of three measurements (except footnoted viscosities).

^aShear Rate D = 1/s (single measurement)

^bShear Rate D = 10/s (single measurement)

^cShear Rate D = 100/s (single measurement)

6.3 GC-TPH Distributions

Prudhoe Bay (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
Fraction	0% evap.	6.3% evap.	13.1% evap.	19.7% evap.
Total GC-TPH [†]	549	578	595	561
GC-Saturates/GC-TPH [†]	68.2	68.5	68.4	68.1
GC-Aromatics/GC-TPH [†]	31.8	31.5	31.6	31.9
Resolved Peaks/GC-TPH	22.1	19.2	17.5	15.9
GC-TPH in ranges: [†]				
<i>n</i> -C ₈ ≤ to ≤ <i>n</i> -C ₁₀	48.8	36.5	15.1	0.88
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	134	130	146	113
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	302	334	354	370
<i>n</i> -C ₃₄ +	63.6	77.6	80.7	76.7

[†]Including both resolved peaks and unresolved complex mixture areas.

6.4 BTEX and Alkyl-benzene Distributions

Prudhoe Bay (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
	0% evap.	6.3% evap.	13.1% evap.	19.7% evap.
Benzene	2.19	0.60	0.01	0.00
Toluene	6.20	3.89	0.05	0.00
Ethylbenzene	1.55	1.21	0.18	0.00
<i>meta</i> - and <i>para</i> -Xylene	4.60	4.01	0.77	0.00
<i>ortho</i> -Xylene	1.86	1.66	0.42	0.00
Sum BTEX	16.40	11.36	1.45	0.00
Isopropylbenzene	0.39	0.36	0.13	0.00
Propylbenzene	0.76	0.76	0.36	0.00
3- and 4-Ethyltoluene	1.74	1.67	0.89	0.01
1,3,5-Trimethylbenzene	0.93	0.90	0.53	0.01
2-Ethyltoluene	0.72	0.70	0.42	0.01
1,2,4-Trimethylbenzene	1.60	1.58	1.06	0.04
1,2,3-Trimethylbenzene	0.25	0.25	0.16	0.01
Sum C₃-benzenes	6.39	6.22	3.55	0.08
Isobutylbenzene	0.05	0.06	0.03	0.00
1-Methyl-2-isopropylbenzene	0.05	0.13	0.04	0.00
1,2-Dimethyl-4-ethylbenzene	0.36	0.36	0.32	0.07
Amylbenzene	0.10	0.10	0.09	0.03
n-Hexylbenzene	0.09	0.09	0.09	0.07
BTEX + C₃-benzenes	22.8	17.6	5.00	0.08
All Target BTEX and Alkyl-benzenes	23.4	18.3	5.57	0.26

6.5 *n*-Alkane Distributions

Prudhoe Bay (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
<i>n</i> -Alkane Component	0% evap.	6.3% evap.	13.1% evap.	19.7% evap.
<i>n</i> -C ₈	3.17	2.21	0.12	0.00
<i>n</i> -C ₉	3.52	3.30	1.13	0.00
<i>n</i> -C ₁₀	3.56	3.36	2.52	0.10
<i>n</i> -C ₁₁	3.84	3.91	3.96	1.10
<i>n</i> -C ₁₂	3.77	4.01	4.37	2.66
<i>n</i> -C ₁₃	3.64	3.98	4.45	3.76
<i>n</i> -C ₁₄	3.49	3.75	4.34	3.79
<i>n</i> -C ₁₅	3.50	3.75	4.13	4.08
<i>n</i> -C ₁₆	3.06	3.35	3.94	3.99
<i>n</i> -C ₁₇	3.07	3.32	3.70	3.78
Pristane	1.86	2.01	2.24	2.27
<i>n</i> -C ₁₈	2.74	2.93	3.29	3.38
Phytane	1.42	1.52	1.70	1.73
<i>n</i> -C ₁₉	2.42	2.53	2.84	2.90
<i>n</i> -C ₂₀	2.36	2.51	2.75	2.88
<i>n</i> -C ₂₁	2.15	2.35	2.64	2.67
<i>n</i> -C ₂₂	2.05	2.25	2.53	2.59
<i>n</i> -C ₂₃	1.95	2.08	2.33	2.39
<i>n</i> -C ₂₄	1.86	1.97	2.20	2.22
<i>n</i> -C ₂₅	1.66	1.78	1.93	1.99
<i>n</i> -C ₂₆	1.65	1.75	1.90	1.96
<i>n</i> -C ₂₇	1.21	1.28	1.40	1.49
<i>n</i> -C ₂₈	1.01	1.01	1.15	1.17
<i>n</i> -C ₂₉	0.79	0.89	0.96	1.01
<i>n</i> -C ₃₀	0.62	0.68	0.72	0.76
<i>n</i> -C ₃₁	0.50	0.57	0.61	0.65
<i>n</i> -C ₃₂	0.38	0.45	0.49	0.54
<i>n</i> -C ₃₃	0.37	0.43	0.45	0.48
<i>n</i> -C ₃₄	0.33	0.36	0.40	0.43
<i>n</i> -C ₃₅	0.27	0.35	0.38	0.40
<i>n</i> -C ₃₆	0.16	0.20	0.22	0.25
<i>n</i> -C ₃₇	0.13	0.17	0.19	0.21
<i>n</i> -C ₃₈	0.12	0.16	0.17	0.19
<i>n</i> -C ₃₉	0.09	0.11	0.16	0.17
<i>n</i> -C ₄₀	0.08	0.10	0.12	0.15
<i>n</i> -C ₄₁	0.06	0.07	0.08	0.11
<i>n</i> -C ₄₂	0.05	0.06	0.07	0.09
<i>n</i> -C ₄₃	0.04	0.05	0.06	0.07
<i>n</i> -C ₄₄	0.03	0.04	0.05	0.05
TOTAL	63.0	65.6	66.7	58.4
C ₁₇ /PRISTANE	1.65	1.65	1.65	1.66
C ₁₈ /PHYTANE	1.94	1.93	1.94	1.95
PRISTANE/PHYTANE	1.31	1.32	1.32	1.31
Odd Alkanes	29.2	30.9	31.4	27.2
Even Alkanes	30.5	31.1	31.4	27.2
CPI	0.96	0.99	1.00	1.00

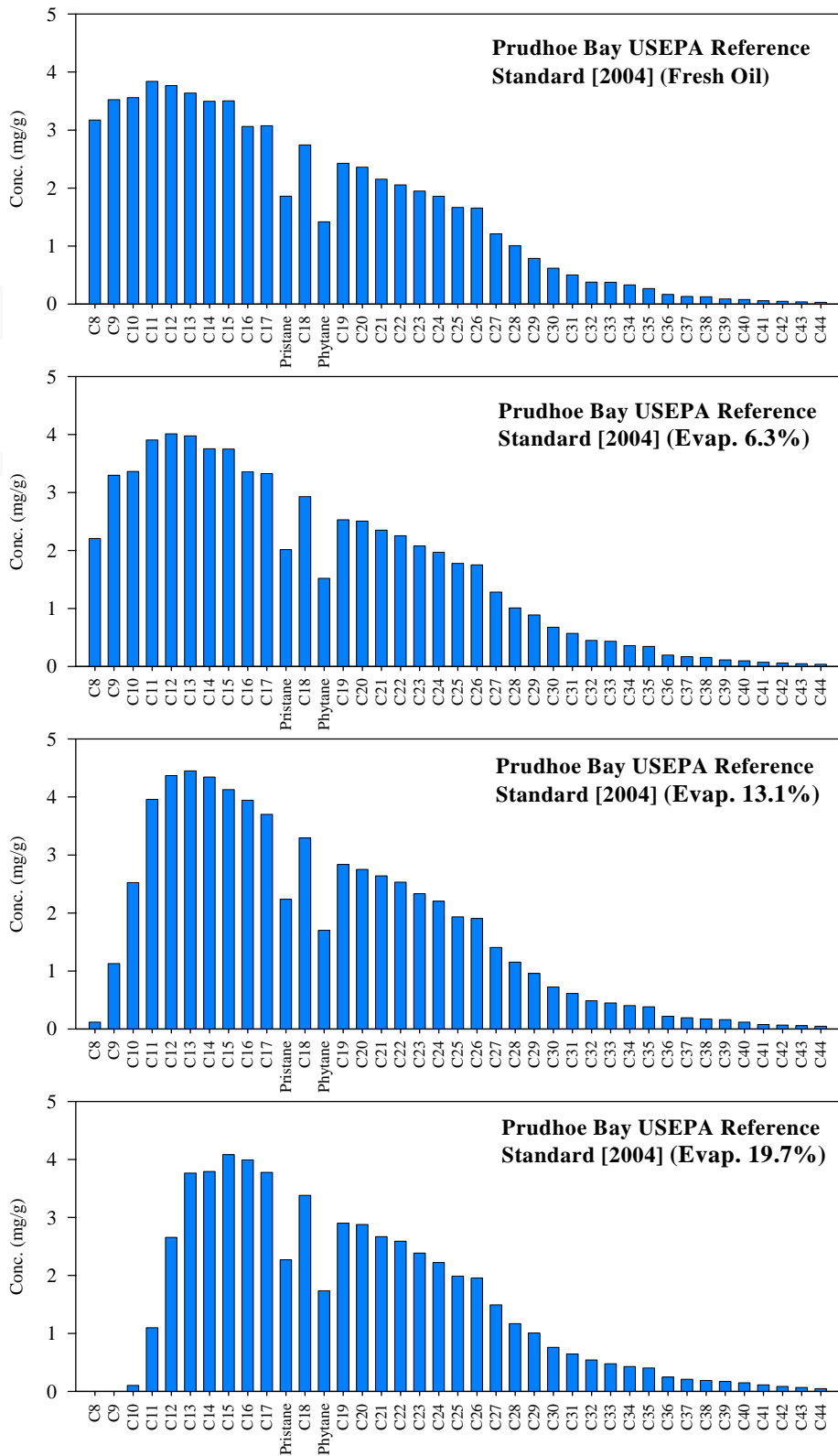


Figure 16 *n*-Alkane Distributions for Prudhoe Bay USEPA Reference Standard [2004]

6.6 PAH Distributions

		Prudhoe Bay (USEPA Reference Standard) [2004] Concentration (µg/g oil)			
Alkylated PAHs		0% evap.	6.3% evap.	13.1% evap.	19.7% evap.
Naphthalene	C0-N	654	670	725	365
	C1-N	2187	2211	2527	1939
	C2-N	3091	3099	3570	3194
	C3-N	2623	2650	3020	2901
	C4-N	1601	1635	1743	1822
	Sum	10157	10265	11586	10221
Phenanthrene	C0-P	327	335	372	376
	C1-P	865	908	1002	1025
	C2-P	1036	1075	1158	1221
	C3-P	887	930	997	1028
	C4-P	579	592	635	668
	Sum	3694	3840	4164	4318
Dibenzothiophene	C0-D	223	233	252	260
	C1-D	422	445	485	496
	C2-D	654	698	749	777
	C3-D	529	561	602	640
	Sum	1828	1937	2088	2172
Fluorene	C0-F	94.8	96.7	106	107
	C1-F	251	267	283	292
	C2-F	405	439	458	479
	C3-F	438	475	485	507
	Sum	1189	1277	1332	1385
Chrysene	C0-C	56.4	61.4	64.6	68.0
	C1-C	92.2	98.3	113	122
	C2-C	138	146	153	160
	C3-C	113	122	131	137
	Sum	400	428	461	487
Total alkylated PAHs		17268	17748	19631	18583
C2-N/C1-N		1.31	1.32	1.30	1.27
Ratios of C3-D isomers		1.00:0.60:0.33	1.00:0.60:0.33	1.00:0.60:0.33	1.00:0.61:0.33
Ratio of C1-P isomers		1.34	1.32	1.33	1.33
(C2D/C2P):(C3D/C3P)		0.63:0.60	0.65:0.60	0.65:0.60	0.64:0.62
C0N:C1N:C2N:C3N:C4N		0.41:1.37:1.93:1.64:1.00	0.41:1.35:1.90:1.62:1.00	0.40:1.39:1.96:1.66:1.00	0.21:1.10:1.82:1.65:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		2.75:1.00:0.49:0.32:0.11	2.67:1.00:0.50:0.33:0.11	2.72:1.00:0.50:0.32:0.11	2.36:1.00:0.50:0.32:0.11
EPA Priority PAHs					
Biphenyl		177	194	214	188
Acenaphthylene		17.8	18.8	19.9	20.5
Acenaphthene		14.6	16.4	17.2	17.8
Anthracene		2.72	2.85	3.15	3.42
Fluoranthene		2.89	3.61	3.66	3.95
Pyrene		13.1	13.5	14.7	14.9
Benz(a)anthracene		3.64	3.77	3.82	4.05
Benzo(b)fluoranthene		9.52	9.55	9.79	10.1
Benzo(k)fluoranthene		0.50	0.53	0.59	0.62
Benzo(e)pyrene		14.0	16.4	17.1	17.6
Benzo(a)pyrene		1.90	1.97	2.08	2.41
Perylene		0.97	1.04	1.12	1.31
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.94	0.96	1.12	1.14
Benzo(ghi)perylene		3.68	3.70	3.72	3.74
Total EPA Priority PAHs		263	288	312	289
TOTAL PAHs		17573	18036	20079	18794

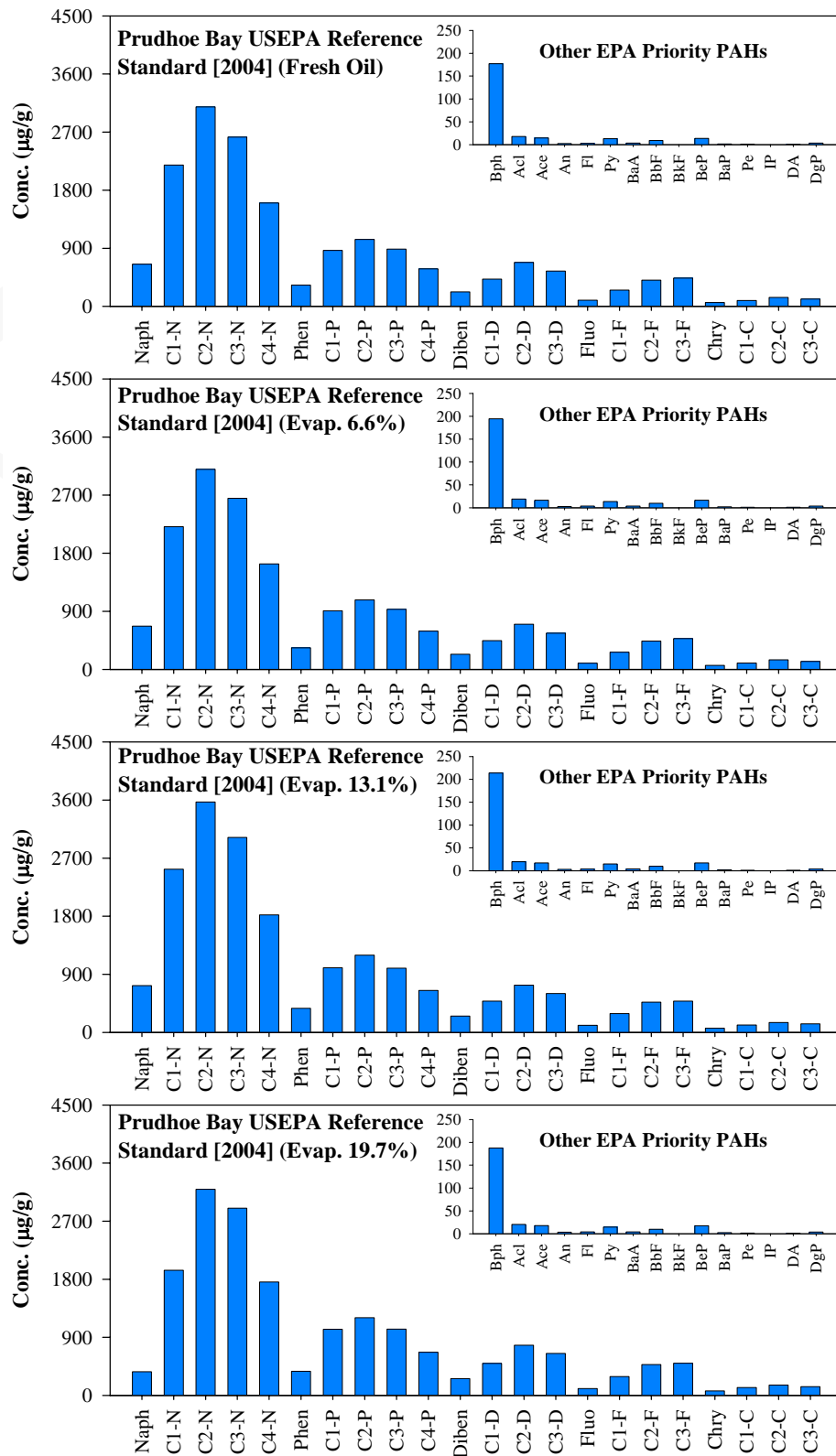


Figure 17 PAH Distributions for Prudhoe Bay USEPA Reference Standard [2004]

6.7 Biomarker Distributions

Prudhoe Bay (USEPA Reference Standard) [2004] Concentration ($\mu\text{g/g}$ oil)				
Biomarker	0% evap.	6.3% evap.	13.1% evap.	19.7% evap.
C21	24.9	27.2	27.7	30.1
C22	9.90	10.9	11.2	12.1
C23	55.7	61.8	65.8	70.0
C24	38.8	42.7	43.1	46.4
C29 hopane	72.4	82.2	84.7	89.3
C30 hopane	125	139	145	152
C31(S)	48.5	54.1	58.8	62.4
C31(R)	34.7	38.6	42.0	46.0
C32(S)	35.9	38.0	41.6	43.1
C32(R)	23.2	24.7	27.2	29.4
C33(S)	24.6	25.7	29.0	31.6
C33(R)	16.7	17.2	19.7	21.5
C34(S)	17.6	18.5	20.6	22.9
C34(R)	10.7	10.9	12.5	13.1
C35(S)	16.7	17.7	21.1	22.4
C35(R)	10.3	11.7	12.6	13.9
Ts	22.0	23.3	25.1	26.5
Tm	29.7	31.7	33.5	34.8
C27 $\alpha\beta$ steranes	183	199	206	220
C28 $\alpha\beta$ steranes	158	180	188	197
C29 $\alpha\beta$ steranes	193	212	223	233
TOTAL	1150	1267	1338	1418
C23/C24	1.43	1.45	1.53	1.51
C23/C30	0.45	0.45	0.45	0.46
C24/C30	0.31	0.31	0.30	0.31
C29/C30	0.58	0.59	0.58	0.59
C31(S)/C31(R)	1.40	1.40	1.40	1.36
C32(S)/C32(R)	1.55	1.54	1.53	1.47
Ts/Tm	0.74	0.74	0.75	0.76
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.95	0.94	0.92	0.95
Σ (C31 to C35) homohopanes	239	257	285	306
C30/ Σ (C31 to C35)	0.52	0.54	0.51	0.50

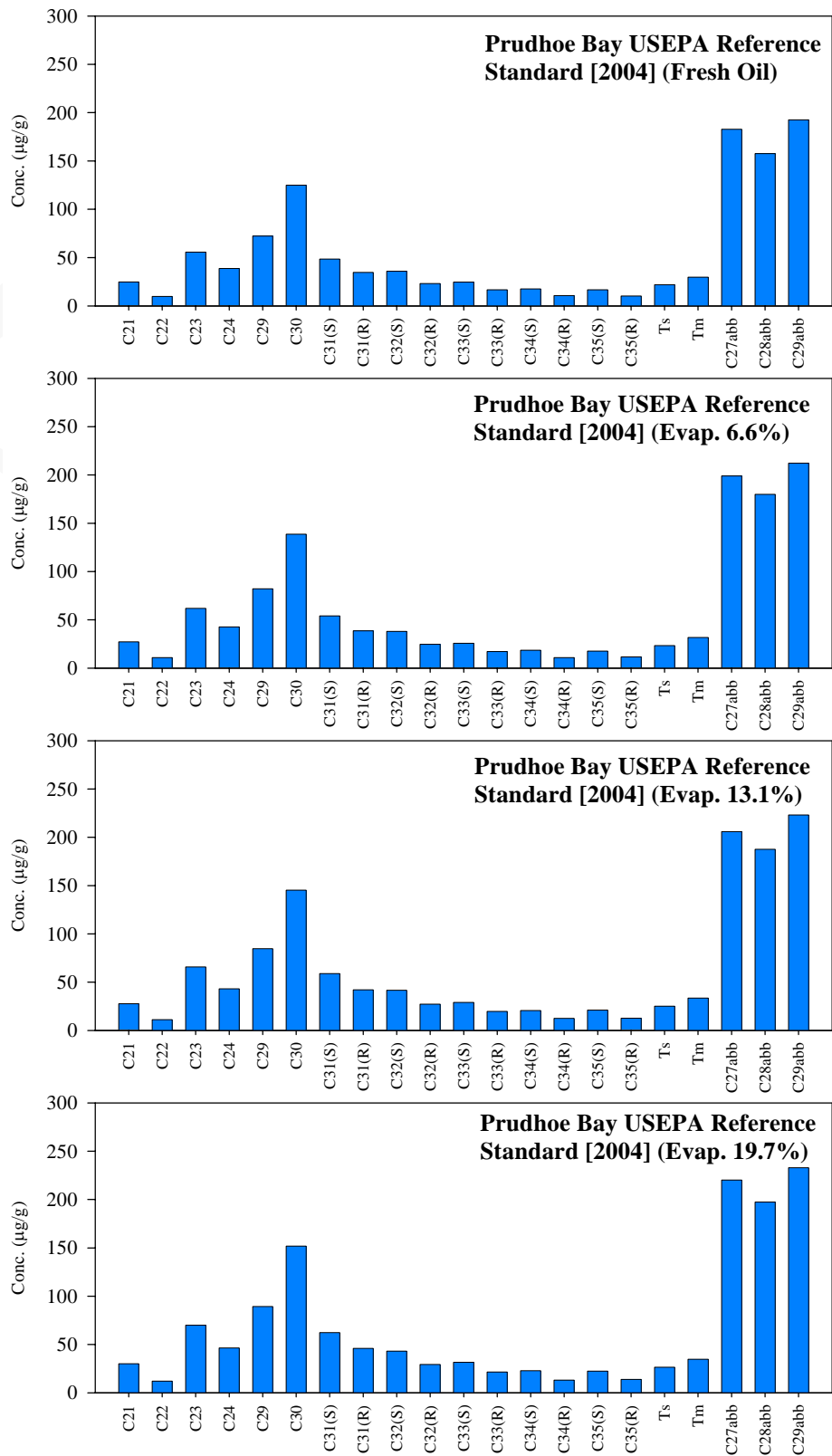


Figure 18 Biomarker Distributions for Prudhoe Bay USEPA Reference Standard [2004]

7. South Louisiana (USEPA Reference Standard) [2004]

7.1 Origin

Gulf of Mexico, U.S.A.

7.2 Physical Properties

		South Louisiana (USEPA Reference Standard) [2004]			
		% Evaporative Mass Loss			
		0.0%	10.3%	20.1%	30.8%
Density (g/mL)	5°C	0.8456	0.8649	0.8773	0.8893
	15°C	0.8389	0.8579	0.8701	0.8815
	30°C	0.8277	0.8472	0.8597	0.8713
API Gravity		37.1			
Dynamic Viscosity (mPa•s)	5°C	10.7	20.1	41.6	113.9
	15°C	7.1	12.6	23.8	46.4
	30°C	5.1	8.0	13.4	22.6
Hydrocarbon Groups (%w/w)	Saturates	79.4%	78.2%	77.7%	73.8%
	Aromatics	16.9%	17.1%	17.4%	18.2%
	Resins	3.4%	4.1%	4.4%	7.2%
	Asphaltenes	0.4%	0.5%	0.5%	0.8%
Surface Tension (mN/m)	5°C	26.7	28.7	29.6	30.5
	15°C	26.6	28.1	29.2	29.9
	30°C	27.2	27.5	28.2	28.9
Interfacial Tension (Oil/Water, mN/m)	5°C	25.0	24.0	20.5	19.8
	15°C	24.9	25.0	24.6	22.4
	30°C	24.0	24.8	24.2	21.7
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	22.3	22.5	20.5	19.4
	15°C	22.0	22.7	22.2	19.4
	30°C	23.7	23.7	23.2	21.4

Note: All values are the average of a minimum of three measurements.

7.3 GC-TPH Distributions

South Louisiana (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
Fraction	0% evap.	10.3% evap.	20.1% evap.	30.8% evap.
Total GC-TPH [†]	688	693	747	719
GC-Saturates/GC-TPH [†]	82.5	82.0	81.7	80.2
GC-Aromatics/GC-TPH [†]	17.5	18.0	18.3	19.8
Resolved Peaks/GC-TPH	20.8	20.6	18.5	15.9
GC-TPH in ranges: [†]				
<i>n</i> -C ₈ ≤ to ≤ <i>n</i> -C ₁₀	68.4	61.2	29.1	1.03
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	196	210	240	195
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	369	367	414	456
<i>n</i> -C ₃₄ +	55.0	55.6	63.2	66.9

[†]Including both resolved peaks and unresolved complex mixture areas.

7.4 BTEX and Alkyl-benzene Distributions

South Louisiana (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
	0% evap.	10.3% evap.	20.1% evap.	30.8% evap.
Benzene	2.65	0.63	0.00	0.00
Toluene	6.33	3.51	0.06	0.00
Ethylbenzene	1.32	1.12	0.19	0.00
<i>meta</i> - and <i>para</i> -Xylene	5.76	5.30	1.29	0.00
<i>ortho</i> -Xylene	2.31	1.94	0.72	0.00
Sum BTEX	18.37	12.50	2.26	0.00
Isopropylbenzene	0.34	0.34	0.15	0.00
Propylbenzene	0.40	0.44	0.23	0.00
3- and 4-Ethyltoluene	1.73	1.75	1.10	0.00
1,3,5-Trimethylbenzene	1.49	1.52	1.10	0.01
2-Ethyltoluene	0.51	0.53	0.36	0.00
1,2,4-Trimethylbenzene	2.12	2.18	1.68	0.03
1,2,3-Trimethylbenzene	0.17	0.18	0.77	0.00
Sum C₃-benzenes	6.76	6.94	5.39	0.06
Isobutylbenzene	0.11	0.12	0.07	0.00
1-Methyl-2-isopropylbenzene	0.05	0.14	0.05	0.00
1,2-Dimethyl-4-ethylbenzene	0.38	0.41	0.38	0.07
Amylbenzene	0.04	0.05	0.04	0.02
n-Hexylbenzene	0.03	0.04	0.04	0.04
BTEX + C₃-benzenes	25.1	19.4	7.65	0.06
All Target BTEX and Alkyl-benzenes	25.7	20.2	8.23	0.18

7.5 *n*-Alkane Distributions

South Louisiana (USEPA Reference Standard) [2004]				
Concentration (mg/g oil)				
<i>n</i> -Alkane Component	0% evap.	10.3% evap.	20.1% evap.	30.8% evap.
<i>n</i> -C ₈	4.23	3.46	0.29	0.00
<i>n</i> -C ₉	4.68	4.77	2.38	0.00
<i>n</i> -C ₁₀	4.71	4.84	4.34	0.15
<i>n</i> -C ₁₁	5.54	6.06	6.63	1.78
<i>n</i> -C ₁₂	5.21	5.87	6.63	4.18
<i>n</i> -C ₁₃	4.94	5.56	6.26	5.53
<i>n</i> -C ₁₄	4.71	5.39	5.80	5.88
<i>n</i> -C ₁₅	4.54	5.18	5.64	6.13
<i>n</i> -C ₁₆	4.12	4.57	5.27	5.42
<i>n</i> -C ₁₇	3.87	4.38	4.98	5.33
Pristane	3.06	3.48	3.91	4.22
<i>n</i> -C ₁₈	3.15	3.59	3.98	4.35
Phytane	1.57	1.80	2.00	2.19
<i>n</i> -C ₁₉	2.56	2.89	3.31	3.57
<i>n</i> -C ₂₀	2.49	2.85	3.06	3.40
<i>n</i> -C ₂₁	2.11	2.36	2.65	2.80
<i>n</i> -C ₂₂	1.85	2.06	2.32	2.51
<i>n</i> -C ₂₃	1.61	1.80	2.03	2.21
<i>n</i> -C ₂₄	1.47	1.65	1.83	1.99
<i>n</i> -C ₂₅	1.33	1.46	1.61	1.83
<i>n</i> -C ₂₆	1.17	1.39	1.45	1.68
<i>n</i> -C ₂₇	0.93	1.05	1.09	1.23
<i>n</i> -C ₂₈	0.78	0.90	0.94	1.01
<i>n</i> -C ₂₉	0.62	0.69	0.76	0.80
<i>n</i> -C ₃₀	0.48	0.53	0.65	0.64
<i>n</i> -C ₃₁	0.39	0.48	0.49	0.54
<i>n</i> -C ₃₂	0.32	0.35	0.36	0.41
<i>n</i> -C ₃₃	0.30	0.33	0.36	0.39
<i>n</i> -C ₃₄	0.27	0.28	0.32	0.36
<i>n</i> -C ₃₅	0.22	0.25	0.30	0.33
<i>n</i> -C ₃₆	0.13	0.16	0.18	0.21
<i>n</i> -C ₃₇	0.09	0.11	0.12	0.14
<i>n</i> -C ₃₈	0.08	0.10	0.10	0.12
<i>n</i> -C ₃₉	0.07	0.08	0.09	0.10
<i>n</i> -C ₄₀	0.06	0.07	0.08	0.09
<i>n</i> -C ₄₁	0.05	0.06	0.07	0.08
<i>n</i> -C ₄₂	0.04	0.05	0.06	0.07
<i>n</i> -C ₄₃	0.03	0.04	0.05	0.06
<i>n</i> -C ₄₄	0.02	0.03	0.04	0.04
TOTAL	73.8	81.0	82.4	71.8
C ₁₇ /PRISTANE	1.26	1.26	1.27	1.26
C ₁₈ /PHYTANE	2.00	2.00	1.99	1.98
PRISTANE/PHYTANE	1.95	1.94	1.96	1.93
Odd Alkanes	33.9	37.6	38.8	32.9
Even Alkanes	35.3	38.1	37.7	32.5
CPI	0.96	0.98	1.03	1.01

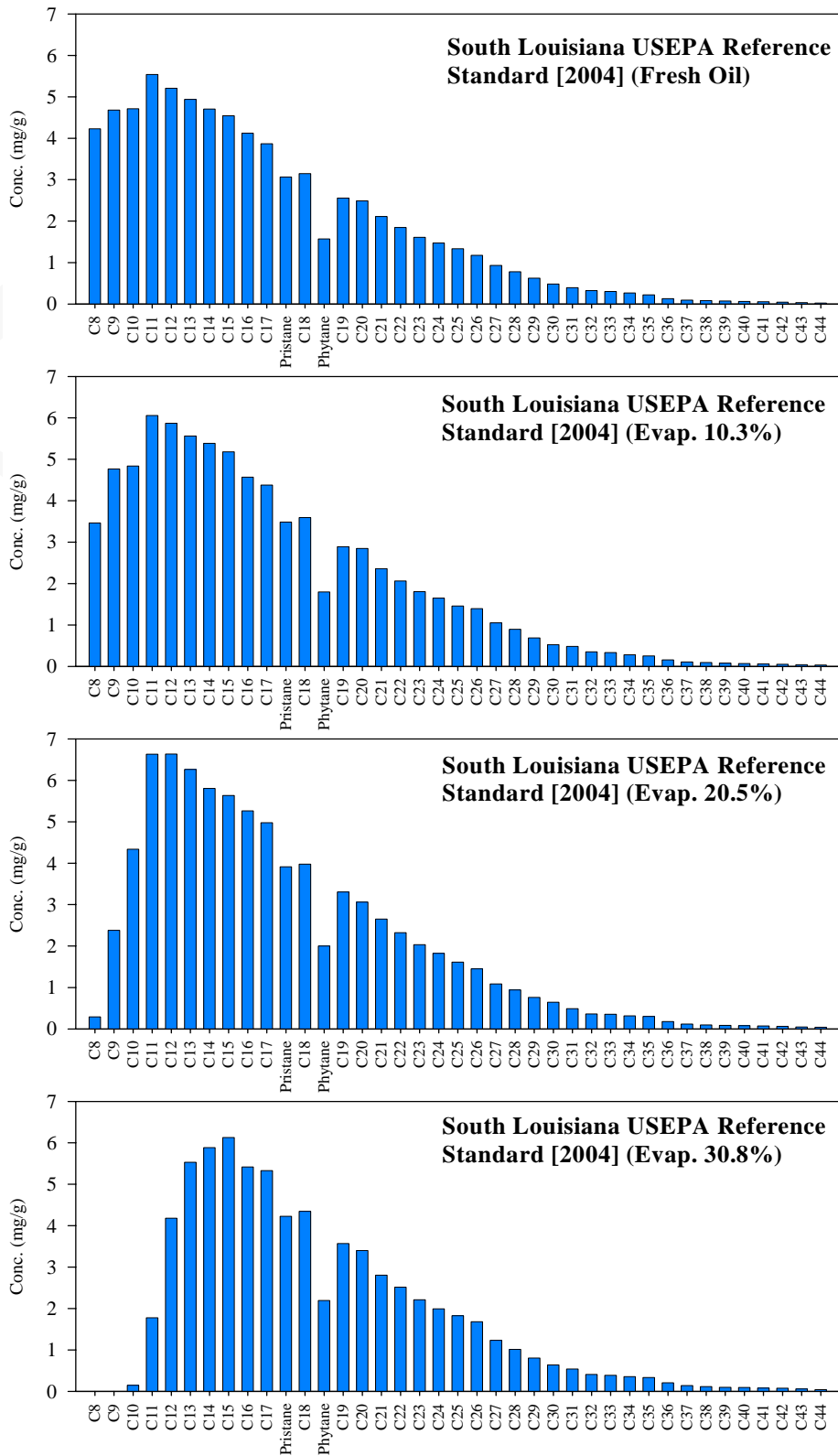


Figure 19 *n*-Alkane Distributions for South Louisiana USEPA Reference Standard [2004]

7.6 PAH Distributions

South Louisiana (USEPA Reference Standard) [2004]					
Concentration (µg/g oil)					
Alkylated PAHs		0% evap.	10.3% evap.	20.1% evap.	30.8% evap.
Naphthalene	C0-N	806	938	953	398
	C1-N	2026	2335	2500	1951
	C2-N	2920	3324	3622	3523
	C3-N	2563	2777	3093	3337
	C4-N	1544	1697	1821	2060
	Sum	9858	11070	11989	11270
Phenanthrene	C0-P	145	157	177	212
	C1-P	396	439	481	551
	C2-P	460	505	557	629
	C3-P	371	393	451	514
	C4-P	229	255	274	319
	Sum	1601	1748	1939	2224
Dibenzothiophene	C0-D	35.0	35.2	40.4	46.2
	C1-D	85.0	88.1	102	117
	C2-D	201	216	232	264
	C3-D	170	184	202	227
	Sum	491	523	576	654
Fluorene	C0-F	58.9	61.9	72.1	72.0
	C1-F	178	195	220	231
	C2-F	300	314	363	382
	C3-F	273	312	337	363
	Sum	809	883	993	1047
Chrysene	C0-C	8.07	8.47	9.73	10.9
	C1-C	23.3	24.9	28.9	32.1
	C2-C	31.1	34.0	37.5	43.6
	C3-C	24.0	26.8	28.7	33.8
	Sum	86.6	94.3	105	120
Total alkylated PAHs		12844	14320	15601	15315
C2-N/C1-N		1.57	1.59	1.59	1.51
Ratios of C3-D isomers		1.00:0.54:0.17	1.00:0.54:0.18	1.00:0.55:0.21	1.00:0.54:0.20
Ratio of C1-P isomers		0.89	0.88	0.87	0.87
(C2D/C2P):(C3D/C3P)		0.44:0.46	0.43:0.47	0.42:0.45	0.42:0.44
C0N:C1N:C2N:C3N:C4N		0.52:1.31:1.89:1.66:1.00	0.55:1.38:1.96:1.64:1.00	0.52:1.37:1.99:1.70:1.00	0.19:0.95:1.71:1.62:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		6.16:1.00:0.31:0.51:0.05	6.33:1.00:0.30:0.51:0.05	6.18:1.00:0.30:0.51:0.05	5.07:1.00:0.29:0.47:0.05
EPA Priority PAHs					
Biphenyl		153	180	197	179
Acenaphthylene		15.9	18.8	20.5	20.4
Acenaphthene		13.6	16.5	18.4	21.6
Anthracene		3.64	4.31	4.69	4.89
Fluoranthene		3.27	3.87	4.30	4.61
Pyrene		4.83	5.62	6.19	7.02
Benz(a)anthracene		2.67	3.25	3.40	4.01
Benzo(b)fluoranthene		2.08	2.20	2.45	2.54
Benzo(k)fluoranthene		0.09	0.12	0.17	0.24
Benzo(e)pyrene		1.45	1.50	1.89	2.03
Benzo(a)pyrene		0.59	0.62	0.82	0.97
Perylene		21.2	24.6	27.6	30.8
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.23	0.25	0.32	0.36
Benzo(ghi)perylene		0.70	0.78	0.83	0.89
Total EPA Priority PAHs		223	262	289	279
TOTAL PAHs		13067	14582	15890	15594

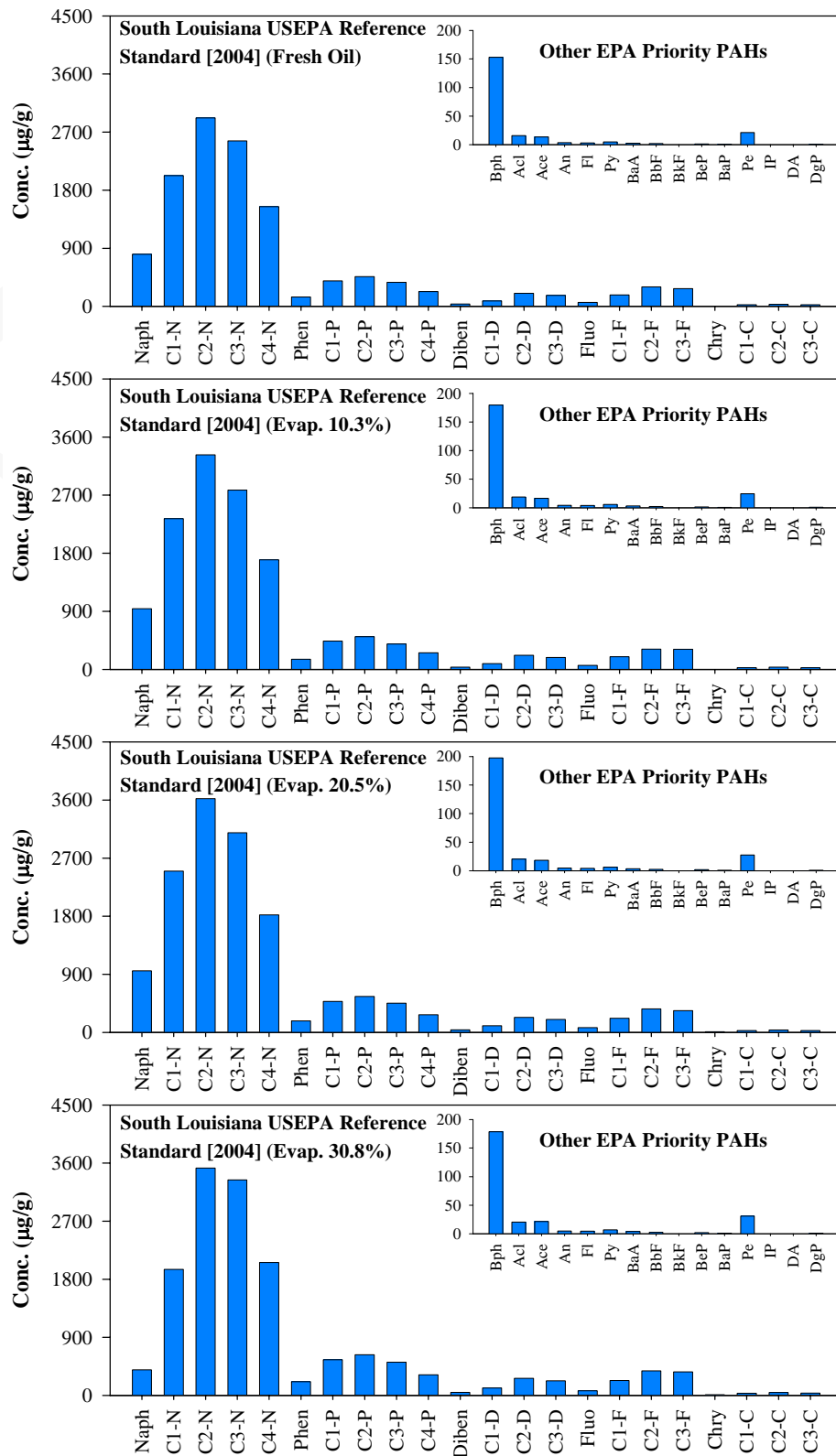


Figure 20 PAH Distributions for South Louisiana USEPA Reference Standard [2004]

7.7 Biomarker Distributions

South Louisiana (USEPA Reference Standard) [2004]				
Concentration ($\mu\text{g/g oil}$)				
Biomarker	0% evap.	10.3% evap.	20.1% evap.	30.8% evap.
C21	9.43	10.2	10.9	12.3
C22	3.53	3.85	4.23	4.49
C23	14.8	15.8	17.7	20.8
C24	10.7	11.2	12.7	15.3
C29 hopane	74.6	79.1	90.3	97.7
C30 hopane	100	105	120	132
C31(S)	26.4	29.0	31.9	33.9
C3(R)	21.5	23.4	26.1	27.9
C32(S)	15.2	16.6	18.0	21.5
C32(R)	9.94	10.8	11.6	13.9
C33(S)	8.96	9.63	10.4	11.0
C33(R)	5.48	6.40	6.83	7.96
C34(S)	4.65	5.30	6.20	6.46
C34(R)	2.78	3.56	3.63	3.80
C35(S)	3.33	3.46	3.99	4.63
C35(R)	2.27	2.46	2.53	2.96
Ts	20.3	21.4	23.3	25.2
Tm	29.6	30.5	32.6	35.4
C27 $\alpha\beta$ steranes	89.3	94.5	105	117
C28 $\alpha\beta$ steranes	67.4	73.4	80.3	91.0
C29 $\alpha\beta$ steranes	89.8	93.8	103	118
TOTAL	610	649	722	804
C23/C24	1.39	1.41	1.39	1.35
C23/C30	0.15	0.15	0.15	0.16
C24/C30	0.11	0.11	0.11	0.12
C29/C30	0.75	0.75	0.75	0.74
C31(S)/C31(R)	1.23	1.24	1.22	1.21
C32(S)/C32(R)	1.53	1.53	1.55	1.55
Ts/Tm	0.69	0.70	0.71	0.71
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.99	1.01	1.01	0.99
Σ (C31 to C35) homohopanes	101	111	121	134
C30/ Σ (C31 to C35)	0.99	0.95	0.99	0.98

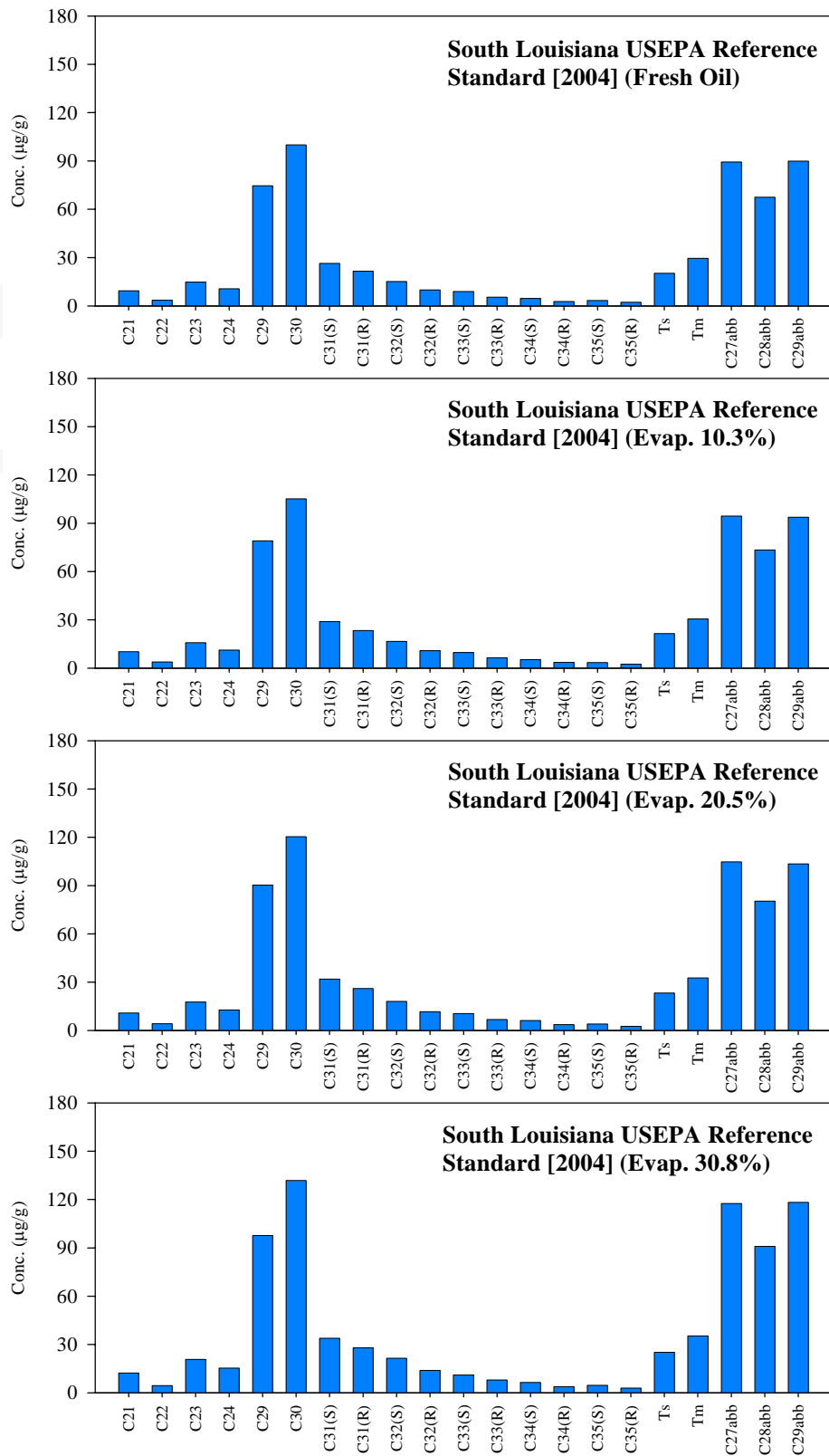


Figure 21 Biomarker Distributions for South Louisiana USEPA Reference [2004]

8. Troll

8.1 Origin

Norway (Courtesy of Irving Oil, Canaport, NB, Canada)

8.2 Physical Properties

		Troll			
		% Evaporative Mass Loss			
		0%	6.3%	13.1%	19.4%
Density (g/mL)	5°C	0.8924	0.9047	0.9138	0.9207
	15°C	0.8852	0.8972	0.906	0.9134
	30°C	0.8747	0.8868	0.8957	0.9029
API Gravity		28.3			
Dynamic Viscosity (mPa•s)	5°C	41	81.2	252.6	471.3
	15°C	23.5	43.6	79.7	175.4
	30°C	13.9	22.4	36	62
Hydrocarbon Groups (%w/w)	Saturates	66.9%	66.2%	64.9%	62.2%
	Aromatics	26.6%	27.2%	27.7%	28.6%
	Resins	5.8%	5.9%	6.6%	8.1%
	Asphaltenes	0.7%	0.7%	0.7%	1.1%
Surface Tension (mN/m)	5°C	28.9	29.9	30.7	31.3
	15°C	28.8	29.6	30.2	30.7
	30°C	28.2	29.3	30	30.3
Interfacial Tension (Oil/Water, mN/m)	5°C	24.8	26.1	27.2	29.9
	15°C	24.2	25.2	26.1	25.9
	30°C	23.5	23.9	25.2	26.4
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	23.1	24.1	25.1	26
	15°C	22.6	24	25.4	26.8
	30°C	21.7	23.4	25.3	27

NM — Not Measured (too viscous)

Note: All values are the average of a minimum of three measurements.

8.3 GC-TPH Distributions

Fraction [†]	Troll Concentration (mg/g oil)			
	0% evap.	6.3% evap.	13.1% evap.	19.4% evap
Total GC-TPH	723	709	703	699
GC-Saturates/GC-TPH [†]	71.6%	70.9%	70.1%	68.5%
GC-Aromatics/GC-TPH [†]	28.4%	29.1%	29.9%	31.5%
Resolved Peaks/GC-TPH	15.6%	14.2%	13.2%	11.5%
GC-TPH in ranges:				
<i>n</i> -C ₈ - ≤ to ≤ <i>n</i> -C ₁₀	49.8	36.7	11.7	0.6
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	181	178	167	151
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	429	429	456	477
<i>n</i> -C ₃₄ +	63.5	65.9	68.7	70

[†]Including both resolved peaks and unresolved complex mixture areas.

8.4 BTEX and Alkyl-benzene Distributions

	Troll Concentration (mg/g oil)			
	0% evap.	6.3% evap.	13.1% evap.	19.4% evap
Benzene	0.7	0.13	0.01	0.00
Toluene	2.53	1.40	0.03	0.01
Ethylbenzene	1.43	1.18	0.21	0.01
<i>meta</i> - and <i>para</i> -Xylene	5.03	4.20	0.93	0.03
<i>ortho</i> -Xylene	1.30	1.16	0.32	0.01
Sum BTEX	10.98	8.06	1.49	0.06
Isopropylbenzene	0.43	0.41	0.14	0.00
Propylbenzene	0.61	0.59	0.28	0.01
3- and 4-Ethyltoluene	1.97	1.95	1.03	0.03
1,3,5-Trimethylbenzene	1.22	1.22	0.68	0.03
2-Ethyltoluene	0.67	0.67	0.38	0.01
1,2,4-Trimethylbenzene	2.09	2.13	1.36	0.08
1,2,3-Trimethylbenzene	0.37	0.39	0.24	0.02
Sum C₃-benzenes	7.36	7.34	4.12	0.18
Isobutylbenzene	0.11	0.14	0.08	0.00
1-Methyl-2-isopropylbenzene	0.07	0.08	0.06	0.01
1,2-Dimethyl-4-ethylbenzene	0.46	0.50	0.43	0.11
Amylbenzene	0.06	0.05	0.05	0.02
n-Hexylbenzene	0.05	0.06	0.07	0.05
BTEX + C₃-benzenes	18.34	15.40	5.61	0.24
All Target BTEX and Alkyl-benzenes	19.10	16.22	6.3	0.44

8.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	Troll			
	0% evap.	6.3% evap.	13.1% evap.	19.4% evap
-C ₈	0.91	0.59	0.04	0
<i>n</i> -C ₉	0.97	0.88	0.27	0
<i>n</i> -C ₁₀	1.05	1.13	0.73	0.05
<i>n</i> -C ₁₁	1.39	1.57	1.19	0.45
<i>n</i> -C ₁₂	1.44	1.62	1.55	1.17
<i>n</i> -C ₁₃	1.28	1.42	1.55	1.57
<i>n</i> -C ₁₄	1.4	1.56	1.63	1.72
<i>n</i> -C ₁₅	1.82	1.96	2.07	2.23
<i>n</i> -C ₁₆	1.57	1.71	1.85	1.98
<i>n</i> -C ₁₇	1.83	1.89	2.01	2.15
Pristane	3.04	3.12	3.36	3.64
<i>n</i> -C ₁₈	1.63	1.72	1.83	1.97
Phytane	1.55	1.61	1.75	1.89
<i>n</i> -C ₁₉	1.31	1.37	1.54	1.63
<i>n</i> -C ₂₀	1.39	1.48	1.57	1.71
<i>n</i> -C ₂₁	1.21	1.29	1.39	1.48
<i>n</i> -C ₂₂	1.14	1.22	1.3	1.38
<i>n</i> -C ₂₃	1.09	1.15	1.26	1.34
<i>n</i> -C ₂₄	1.12	1.2	1.33	1.39
<i>n</i> -C ₂₅	1.1	1.2	1.3	1.41
<i>n</i> -C ₂₆	1	1.06	1.11	1.23
<i>n</i> -C ₂₇	0.91	0.99	1.05	1.13
<i>n</i> -C ₂₈	0.83	0.89	0.98	1.04
<i>n</i> -C ₂₉	0.69	0.73	0.85	0.92
<i>n</i> -C ₃₀	0.61	0.66	0.72	0.8
<i>n</i> -C ₃₁	0.54	0.58	0.65	0.71
<i>n</i> -C ₃₂	0.38	0.42	0.46	0.51
<i>n</i> -C ₃₃	0.55	0.59	0.62	0.67
<i>n</i> -C ₃₄	0.58	0.61	0.66	0.7
<i>n</i> -C ₃₅	0.38	0.41	0.48	0.51
<i>n</i> -C ₃₆	0.2	0.21	0.24	0.24
<i>n</i> -C ₃₇	0.12	0.13	0.16	0.16
<i>n</i> -C ₃₈	0.14	0.15	0.18	0.19
<i>n</i> -C ₃₉	0.12	0.14	0.17	0.18
<i>n</i> -C ₄₀	0.1	0.12	0.14	0.15
<i>n</i> -C ₄₁	0.1	0.11	0.12	0.13
<i>n</i> -C ₄₂	0.08	0.09	0.1	0.11
<i>n</i> -C ₄₃	0.04	0.05	0.06	0.06
<i>n</i> -C ₄₄	0.02	0.03	0.04	0.05
TOTAL	35.6	37.7	38.3	38.7
C ₁₇ /PRISTANE	0.6	0.61	0.6	0.59
C ₁₈ /PHYTANE	1.05	1.06	1.05	1.04
PRISTANE/PHYTANE	1.96	1.93	1.92	1.92
Odd Alkanes	15.5	16.5	16.7	16.7
Even Alkanes	15.6	16.5	16.4	16.4
CPI	0.99	1	1.02	1.02

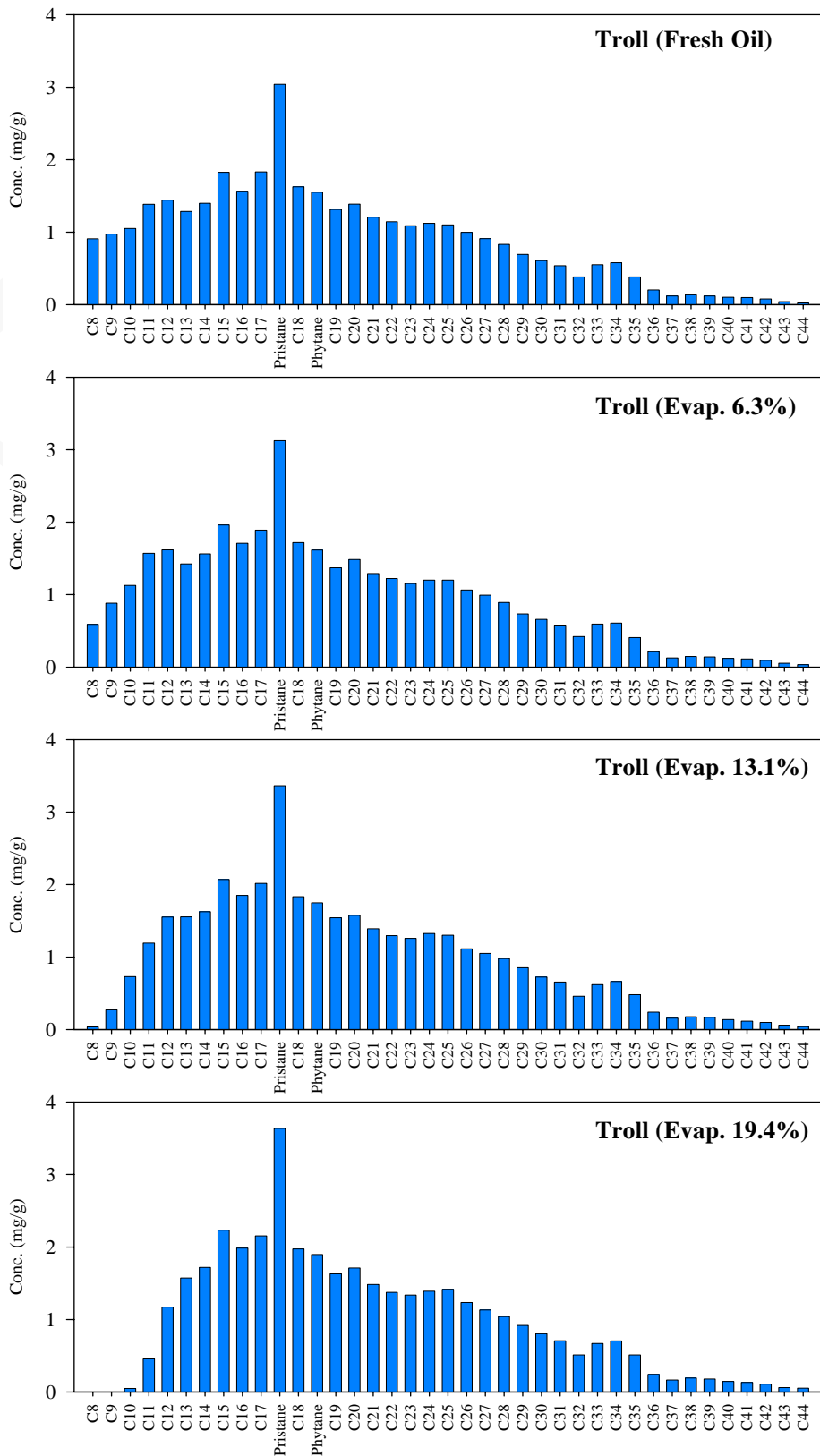


Figure 22 *n*-Alkanes Distributions for Troll

8.6 PAH Distributions

		Troll Concentration ($\mu\text{g/g}$ oil)			
		0% evap.	6.3% evap.	13.1% evap.	19.4% evap.
Alkylated PAHs					
Naphthalene	C0-N	967	863	878	515
	C1-N	2900	2688	3074	2636
	C2-N	3646	3587	4020	4073
	C3-N	2837	2960	3171	3440
	C4-N	1677	1763	1863	2069
	Sum	12027	11861	13005	12733
Phenanthrene	C0-P	269	280	299	330
	C1-P	585	607	646	716
	C2-P	640	660	700	777
	C3-P	543	553	596	697
	C4-P	410	415	438	508
	Sum	2448	2514	2678	3028
Dibenzothiophene	C0-D	39.2	39.7	42.8	47.3
	C1-D	125	127	134	149
	C2-D	182	185	194	221
	C3-D	153	163	176	203
	Sum	499	515	547	620
Fluorene	C0-F	161	167	179	195
	C1-F	347	359	384	414
	C2-F	484	494	530	569
	C3-F	396	431	452	503
	Sum	1388	1450	1545	1680
Chrysene	C0-C	40.3	41.4	43.8	48.2
	C1-C	77.3	83.5	85.8	95.9
	C2-C	119	125	132	147
	C3-C	71.8	83	90	96.5
	Sum	309	332	352	388
Total alkylated PAHs		16670	16673	18127	18449
C2-N/C1-N		2.11	2.1	2.09	2.05
Ratios of C3-D isomers		1.00:0.54:0.26	1.00:0.55:0.26	1.00:0.55:0.26	1.00:0.56:0.26
Ratios of C2-P isomers (C2D/C2P):(C3D/C3P)		1.15	1.16	1.14	1.15
(C2D/C2P):(C3D/C3P)		0.28:0.28	0.28:0.29	0.28:0.30	0.28:0.29
C0N:C1N:C2N:C3N:C4N		0.58:1.73:2.17:1.69:1.00	0.49:1.52:2.03:1.68:1.00	0.47:1.65:2.16:1.70:1.00	0.25:1.27:1.97:1.66:1.00
$\sum\text{N}:\sum\text{P}:\sum\text{DBT}:\sum\text{F}:\sum\text{C}$		4.91:1.00:0.20:0.57:0.13	4.72:1.00:0.20:0.58:0.13	4.86:1.00:0.20:0.58:0.13	4.21:1.00:0.20:0.55:0.13
EPA Priority PAHs					
Biphenyl		288	291	312	317
Acenaphthylene		16.4	18.4	20.4	22.4
Acenaphthene		53.7	62.6	66.7	68.6
Anthracene		2.96	3.29	3.63	5.49
Fluoranthene		12.6	13.6	15.2	15.5
Pyrene		16.3	16.8	17.8	15.7
Benz(a)anthracene		7.75	7.83	8.41	9.79
Benzo(b)fluoranthene		9.68	9.83	10.1	11.8
Benzo(k)fluoranthene		0.88	1.18	1.26	1.54
Benzo(e)pyrene		11.1	11.7	12	14
Benzo(a)pyrene		3.15	3.27	3.51	4.08
Perylene		4.7	4.92	5.09	5.83
Indeno(1,2,3cd)pyrene		1.4	1.49	1.58	1.7
Dibenzo(a,h)anthracene		1.5	1.62	1.68	1.72
Benzo(ghi)perylene		3.61	3.67	3.7	4.19
Total EPA Priority PAHs		434	451	483	499
TOTAL PAHs		17104	17124	18609	18948

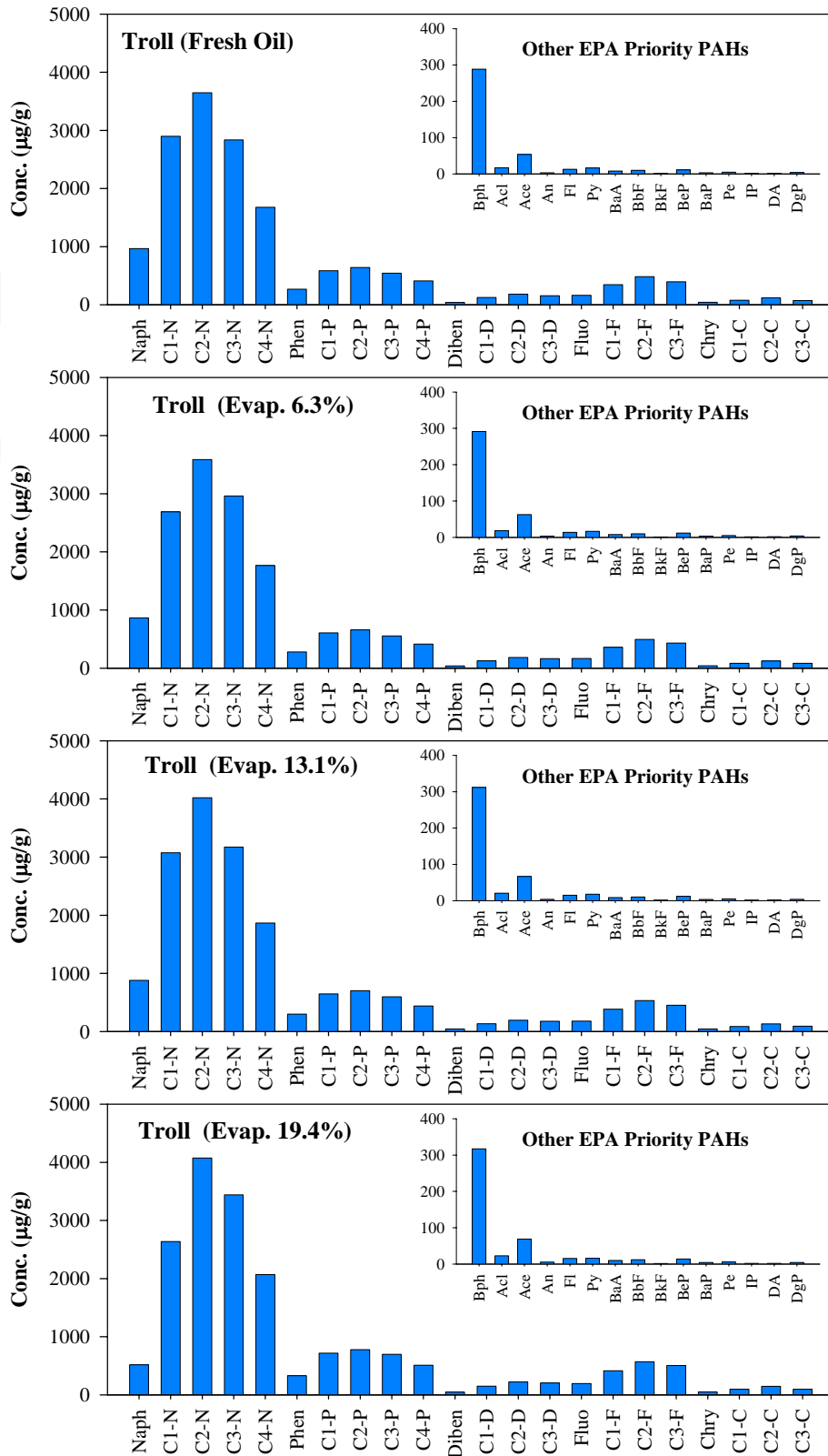


Figure 23 PAH Distributions for Troll

8.7 Biomarker Distributions

Biomarker	Troll Concentration ($\mu\text{g/g oil}$)			
	0% evap.	6.3% evap.	13.1% evap.	19.4% evap
C21	7.81	8.34	8.82	10.2
C22	2.96	3.38	3.51	4.36
C23	11.1	11.8	12	13.6
C24	9.14	9.61	9.81	10.8
C29 hopane	56.6	59.5	64.7	68.2
C30 hopane	126	132	143	150
C31(S)	44.3	47	49.6	53.1
C31(R)	34.5	36.7	39	42.6
C32(S)	30.4	32.6	35.3	37.9
C32(R)	22	23.8	26.1	27.2
C33(S)	26.7	27.3	29.1	30.7
C33(R)	16.3	16.6	18.7	19.3
C34(S)	16.4	16.7	19	19.4
C34(R)	9.54	9.81	10.7	11
C35(S)	12.4	13.4	14.2	14.9
C35(R)	8.73	9.32	9.64	10.1
Ts	34.1	35.5	36.4	38.7
Tm	23.3	24.2	24.9	26.5
C27 $\alpha\beta$ steranes	172	177	185	199
C28 $\alpha\beta$ steranes	125	130	143	157
C29 $\alpha\beta$ steranes	179	184	197	213
TOTAL	968	1008	1080	1158
C23/C24	1.22	1.23	1.26	1.25
C23/C30	0.09	0.09	0.09	0.09
C24/C30	0.07	0.07	0.07	0.07
C29/C30	0.45	0.45	0.45	0.45
C31(S)/C31(R)	1.28	1.28	1.27	1.25
C32(S)/C32(R)	1.38	1.37	1.35	1.39
Ts/Tm	1.46	1.46	1.46	1.46
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.96	0.96	0.94	0.93
Σ (C31 to C35) homohopanes	221	233	251	266
C30/ Σ (C31 to C35)	0.57	0.57	0.57	0.57

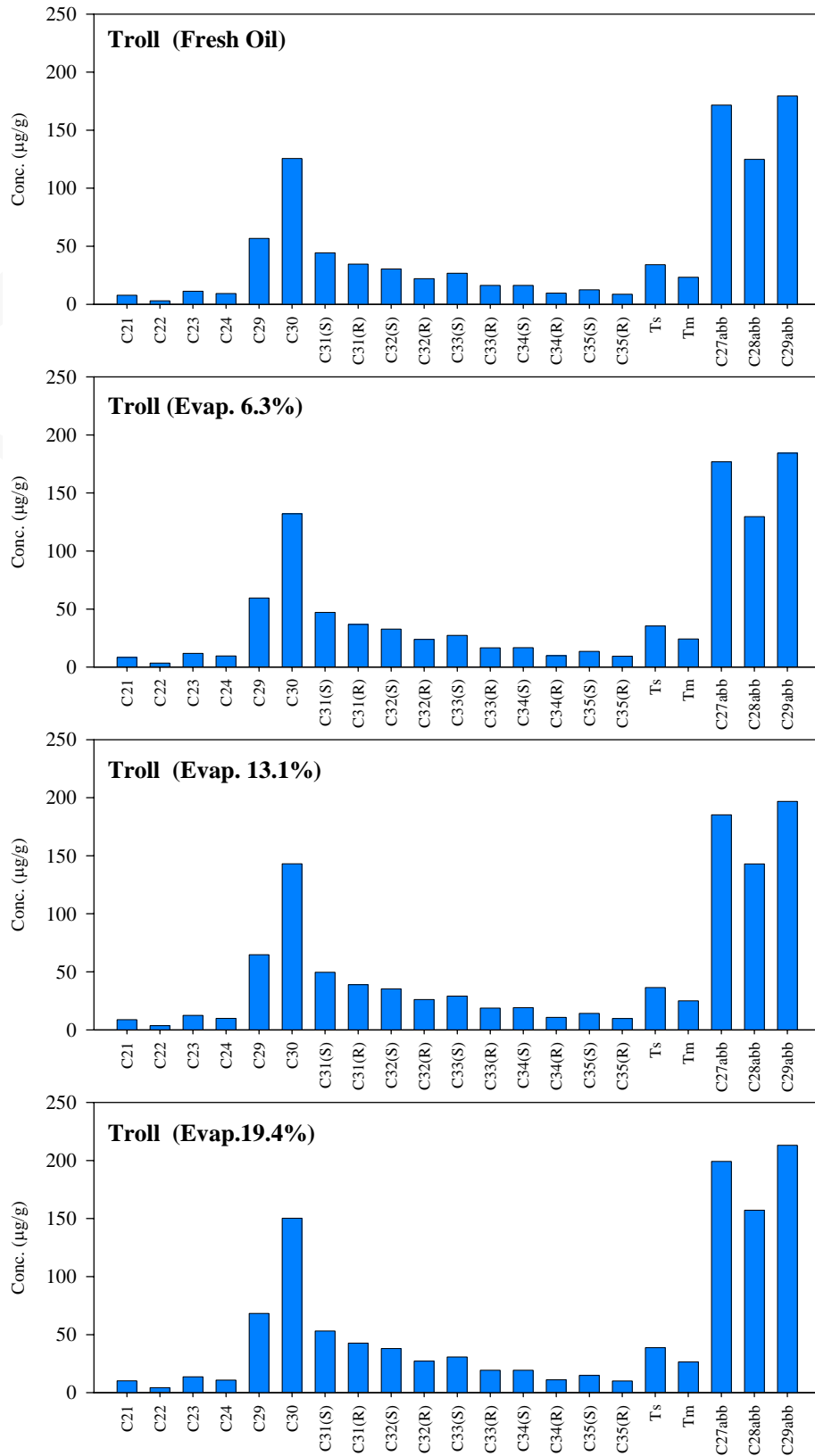


Figure 24 Biomarker Distributions for Troll

9. West Delta Block 143

9.1 Origin

Gulf of Mexico, U.S.A.

9.2 Physical Properties

		West Delta Block 143 % Evaporative Mass Loss			
		0.0%	8.5%	17.3%	25.8%
Density (g/mL)	5°C	0.8883	0.912	0.9303	0.9505
	15°C	0.8806	0.9049	0.9232	0.9431
	30°C	0.8700	0.8946	0.9132	0.9334
API Gravity		29.1			
Dynamic Viscosity (mPa•s)	5°C	45.1	126.1	459.4	3225
	15°C	28.8	71.7	222.7	1214
	30°C	16.4	36.8	93.9	391.7
Hydrocarbon Groups (%w/w)	Saturates	61.0%	59.0%	55.8%	49.9%
	Aromatics	26.6%	28.0%	28.1%	28.0%
	Resins	8.9%	9.0%	11.2%	15.4%
	Asphaltenes	3.6%	4.0%	4.9%	6.7%
Surface Tension (mN/m)	5°C	27.7	28.9	30.1	NM
	15°C	27.6	28.5	29.5	NM
	30°C	25.9	27.7	28.9	30.2
Interfacial Tension (Oil/Water, mN/m)	5°C	23.8	26.4	28	NM
	15°C	23.9	27.8	29	NM
	30°C	26.2	27.2	24.9	21.8
Interfacial Tension (Oil/33% Brine, mN/m)	5°C	25.5	26.6	28	NM
	15°C	23.5	26.2	27.7	NM
	30°C	25.6	25.9	24.7	20.9

Note: All values are the average of a minimum of three measurements.

9.3 GC-TPH Distributions

Fraction	West Delta Block 143 Concentration (mg/g oil)			
	0% evap.	8.5% evap.	17.3% evap.	25.8% evap.
Total GC-TPH [†]	569	578	591	582
GC-Saturates/GC-TPH [†]	70.0%	67.8%	66.9%	64.1%
GC-Aromatics/GC-TPH [†]	30.0%	32.2%	33.1%	35.9%
Resolved Peaks/GC-TPH	19.7%	18.7%	17.0%	12.7%
GC-TPH in ranges: [†]				
<i>n</i> -C ₈₋ ≤ to ≤ <i>n</i> -C ₁₀	54.3	49.5	30.2	0.35
<i>n</i> -C ₁₀ < to ≤ <i>n</i> -C ₁₆	133	129	147	129
<i>n</i> -C ₁₆ < to ≤ <i>n</i> -C ₃₄	314	331	345	381
<i>n</i> -C ₃₄ +	67.8	68.2	69.3	71.7

[†]Including both resolved peaks and unresolved complex mixture areas.

9.4 BTEX and Alkyl-benzene Distributions

	West Delta Block 143 Concentration (mg/g oil)			
	0% evap.	8.5% evap.	17.3% evap.	25.8% evap.
Benzene	0.54	0.25	0.00	0.00
Toluene	2.63	2.07	0.19	0.00
Ethylbenzene	0.98	0.97	0.37	0.00
<i>meta</i> - and <i>para</i> -Xylene	3.20	3.09	1.36	0.00
<i>ortho</i> -Xylene	1.48	1.48	0.77	0.00
Sum BTEX	8.82	7.86	2.69	0.00
Isopropylbenzene	0.28	0.28	0.17	0.00
Propylbenzene	0.49	0.50	0.36	0.00
3- and 4-Ethyltoluene	1.64	1.74	1.33	0.00
1,3,5-Trimethylbenzene	0.86	0.85	0.71	0.00
2-Ethyltoluene	0.85	0.87	0.70	0.00
1,2,4-Trimethylbenzene	2.10	2.19	1.88	0.02
1,2,3-Trimethylbenzene	0.20	0.21	0.18	0.00
Sum C₃-benzenes	6.41	6.63	5.32	0.04
Isobutylbenzene	0.05	0.05	0.04	0.00
1-Methyl-2-isopropylbenzene	0.05	0.06	0.15	0.00
1,2-Dimethyl-4-ethylbenzene	0.57	0.58	0.60	0.08
Amylbenzene	0.09	0.10	0.1	0.03
n-Hexylbenzene	0.08	0.09	0.1	0.07
BTEX + C₃-benzenes	15.24	14.49	8.02	0.04
All Target BTEX and Alkyl-benzenes	16.08	15.37	8.99	0.22

9.5 *n*-Alkane Distributions

<i>n</i> -Alkane Component	West Delta Block 143 Concentration (mg/g oil)			
	0% evap.	8.5% evap.	17.3% evap.	25.8% evap.
<i>n</i> -C ₈	5.14	4.51	0.9	0
<i>n</i> -C ₉	5.36	4.69	2.9	0
<i>n</i> -C ₁₀	4.79	4.36	4.05	0.05
<i>n</i> -C ₁₁	4.63	4.28	4.87	0.81
<i>n</i> -C ₁₂	4.15	4.03	4.6	2.57
<i>n</i> -C ₁₃	3.69	3.71	4.17	3.6
<i>n</i> -C ₁₄	3.19	3.33	3.65	3.85
<i>n</i> -C ₁₅	2.9	3.06	3.33	3.78
<i>n</i> -C ₁₆	2.43	2.46	2.71	3.06
<i>n</i> -C ₁₇	2.12	2.33	2.64	2.94
Pristane	1.5	1.62	1.85	2.03
<i>n</i> -C ₁₈	1.81	2.03	2.23	2.51
Phytane	1.23	1.35	1.51	1.7
<i>n</i> -C ₁₉	1.47	1.5	1.7	1.94
<i>n</i> -C ₂₀	1.39	1.43	1.64	1.94
<i>n</i> -C ₂₁	1.14	1.21	1.36	1.54
<i>n</i> -C ₂₂	0.96	1.01	1.22	1.37
<i>n</i> -C ₂₃	0.83	0.89	1.08	1.21
<i>n</i> -C ₂₄	0.78	0.85	1.06	1.13
<i>n</i> -C ₂₅	0.73	0.78	1	1.1
<i>n</i> -C ₂₆	0.69	0.75	0.98	1.04
<i>n</i> -C ₂₇	0.51	0.55	0.92	0.98
<i>n</i> -C ₂₈	0.44	0.49	0.84	0.91
<i>n</i> -C ₂₉	0.39	0.41	0.74	0.82
<i>n</i> -C ₃₀	0.33	0.38	0.62	0.75
<i>n</i> -C ₃₁	0.32	0.33	0.53	0.61
<i>n</i> -C ₃₂	0.24	0.26	0.43	0.46
<i>n</i> -C ₃₃	0.25	0.27	0.39	0.42
<i>n</i> -C ₃₄	0.23	0.25	0.3	0.34
<i>n</i> -C ₃₅	0.22	0.23	0.29	0.31
<i>n</i> -C ₃₆	0.16	0.17	0.18	0.19
<i>n</i> -C ₃₇	0.1	0.1	0.13	0.14
<i>n</i> -C ₃₈	0.09	0.09	0.11	0.12
<i>n</i> -C ₃₉	0.08	0.08	0.09	0.11
<i>n</i> -C ₄₀	0.07	0.08	0.08	0.09
<i>n</i> -C ₄₁	0.06	0.07	0.07	0.08
<i>n</i> -C ₄₂	0.05	0.05	0.06	0.07
<i>n</i> -C ₄₃	0.03	0.03	0.03	0.05
<i>n</i> -C ₄₄	0.02	0.03	0.03	0.04
TOTAL	54.5	54.0	55.3	44.6
C ₁₇ /PRISTANE	1.41	1.44	1.43	1.44
C ₁₈ /PHYTANE	1.48	1.5	1.47	1.48
PRISTANE/PHYTANE	1.22	1.2	1.22	1.2
Odd Alkanes	24.8	24.5	26.2	20.4
Even Alkanes	27.0	26.5	25.7	20.5
CPI	0.92	0.92	1.02	1

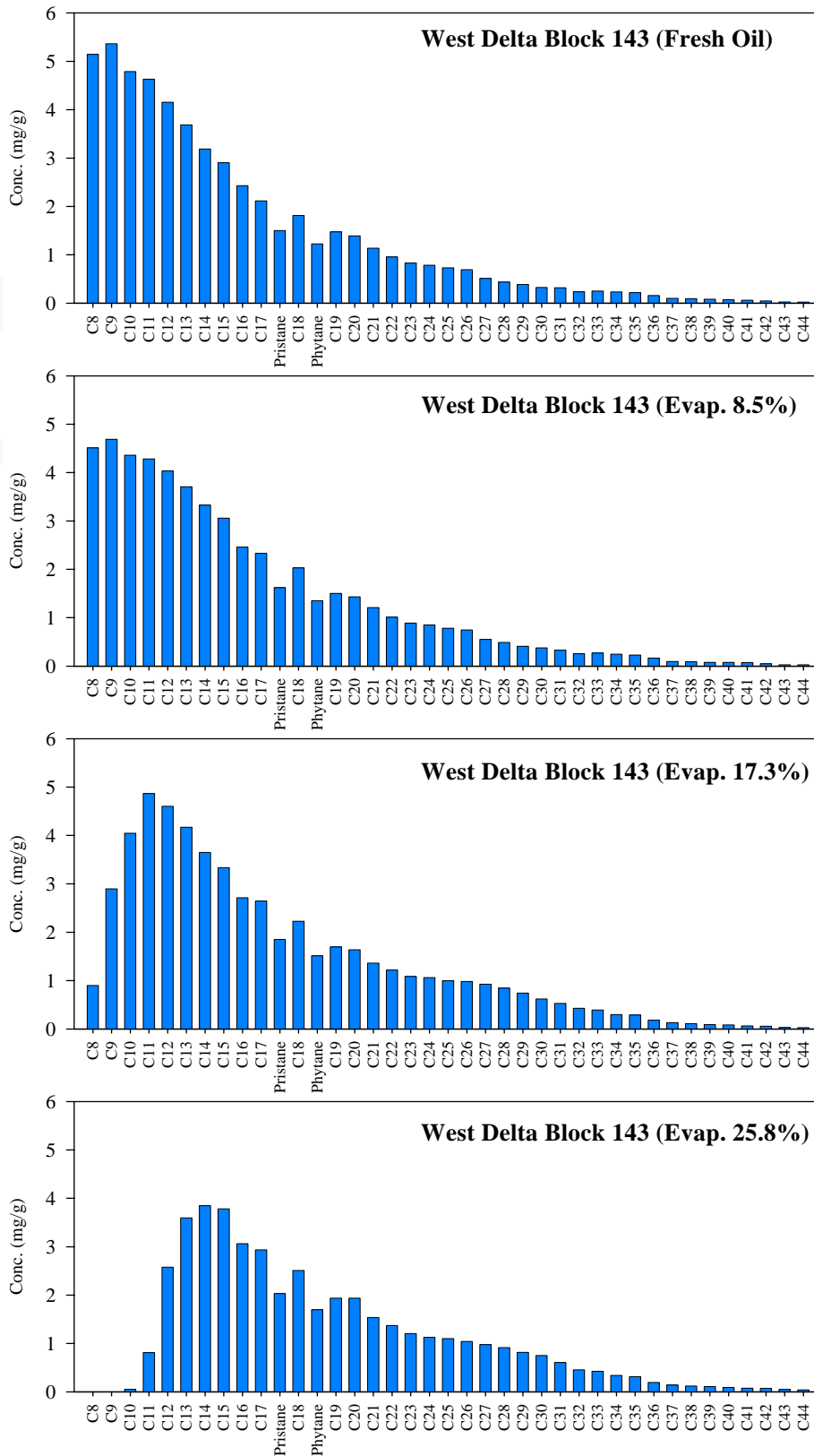


Figure 25 *n*-Alkane Distributions for West Delta Block 143

9.6 PAH Distributions

		West Delta Block 143 Concentration (µg/g oil)			
Alkylated PAHs		0% evap.	8.5% evap.	17.3% evap.	25.8% evap.
Naphthalene	C0-N	180	241	233	117
	C1-N	882	1170	1180	1003
	C2-N	1644	2105	2180	2155
	C3-N	1825	2209	2382	2431
	C4-N	1113	1319	1453	1510
	Sum	5646	7043	7428	7216
Phenanthrene	C0-P	78.0	91.1	97.3	104
	C1-P	266	308	326	351
	C2-P	385	448	464	496
	C3-P	337	382	408	443
	C4-P	240	271	280	313
	Sum	1306	1500	1576	1707
Dibenzothiophene	C0-D	69.9	81.8	87.2	92.8
	C1-D	262	299	318	343
	C2-D	500	579	633	657
	C3-D	487	542	601	626
	Sum	1319	1501	1639	1719
Fluorene	C0-F	25.9	31.0	32.7	34.5
	C1-F	94.9	116	124	131
	C2-F	201	230	241	255
	C3-F	246	269	279	341
	Sum	568	646	677	762
Chrysene	C0-C	15.2	17.4	18.7	20.7
	C1-C	40.0	46.4	49.8	53.3
	C2-C	59.4	68.9	81.8	87.6
	C3-C	54.6	61.8	70.1	84.6
	Sum	169	195	220	246
Total alkylated PAHs		9007	10885	11541	11650
C2-N/C1-N		1.13	1.14	1.13	1.11
Ratios of C3-D isomers		1.00:0.68:0.57	1.00:0.69:0.56	1.00:0.69:0.55	1.00:0.70:0.56
Ratio of C1-P isomers		1.49	1.45	1.44	1.47
(C2D/C2P):(C3D/C3P)		1.30:1.44	1.29:1.40	1.36:1.47	1.32:1.41
C0N:C1N:C2N:C3N:C4N		0.16:0.79:1.48:1.64:1.00	0.18:0.89:1.60:1.68:1.00	0.16:0.81:1.50:1.64:1.00	0.08:0.66:1.43:1.61:1.00
ΣN:ΣP:ΣDBT:ΣF:ΣC		4.32:1.00:1.01:0.43:0.13	4.70:1.00:1.00:0.43:0.13	4.71:1.00:1.04:0.43:0.14	4.23:1.00:1.01:0.45:0.14
EPA Priority PAHs					
Biphenyl		27.9	32.2	35.4	36.2
Acenaphthylene		5.96	7.94	10.4	11.6
Acenaphthene		9.56	12.7	13.2	13.4
Anthracene		1.21	1.35	1.61	1.85
Fluoranthene		0.81	1.12	1.45	1.57
Pyrene		3.49	3.75	3.87	4.35
Benz(a)anthracene		3.10	3.67	3.78	3.88
Benzo(b)fluoranthene		1.67	2.01	2.18	2.30
Benzo(k)fluoranthene		0.34	0.35	0.36	0.37
Benzo(e)pyrene		3.17	3.34	3.52	4.17
Benzo(a)pyrene		0.97	1.11	1.20	1.26
Perylene		9.50	12.2	12.4	13.7
Indeno(1,2,3cd)pyrene		0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene		0.66	0.71	0.76	0.84
Benzo(ghi)perylene		0.92	0.98	1.11	1.15
Total EPA Priority PAHs		69.2	83.4	91.3	96.7
TOTAL PAHs		9077	10969	11632	11747

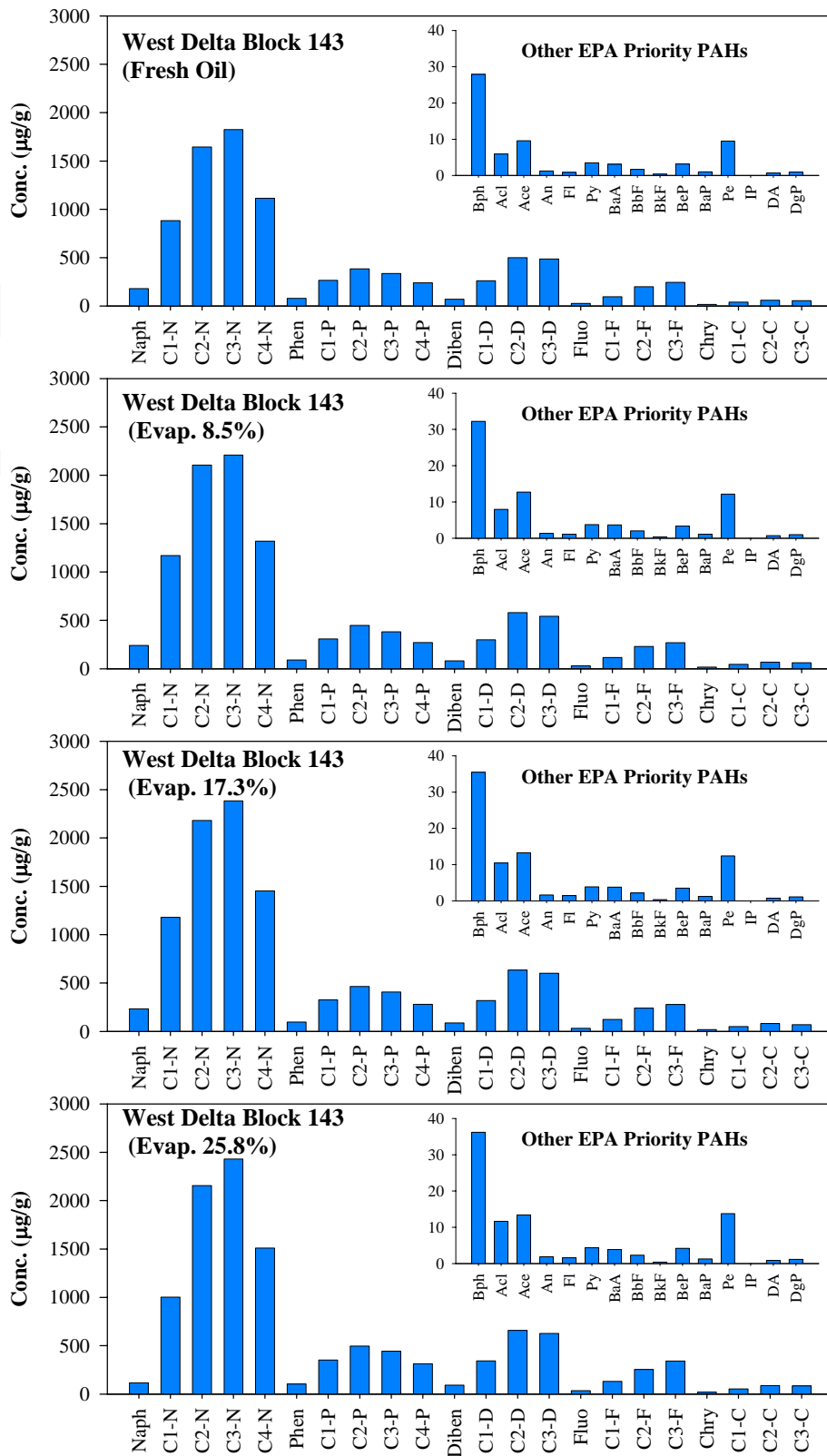


Figure 26 PAH Distributions for West Delta Block 143

9.7 Biomarker Distributions

West Delta Block 143 Concentration ($\mu\text{g/g oil}$)				
Biomarker	0% evap.	8.5% evap.	17.3% evap.	25.8% evap.
C21	5.33	5.61	5.86	6.1
C22	3.07	3.18	3.24	3.58
C23	10.7	11.5	12.5	12.8
C24	6.9	7.48	7.86	8.1
C29 hopane	55.5	58.5	63	66.3
C30 hopane	74.1	79	85.8	92.7
C31(S)	39.1	39.9	43.1	49.7
C31(R)	29.2	30.8	33	38.3
C32(S)	24.3	25.6	28.1	31.3
C32(R)	16.6	17.1	18.9	21.2
C33(S)	16	16.3	18.2	20.8
C33(R)	10.9	11.7	12.6	14.5
C34(S)	8.61	9.33	10.2	11.9
C34(R)	5.62	6.13	6.68	7.53
C35(S)	7.82	8.58	9.53	12.7
C35(R)	5.38	5.87	6.23	7.52
Ts	12.3	13	13.2	14.8
Tm	21.5	23.3	24.1	27.1
C27 $\alpha\beta$ steranes	164	178	188	204
C28 $\alpha\beta$ steranes	119	130	136	145
C29 $\alpha\beta$ steranes	187	200	215	226
TOTAL	824	880	940	1021
C23/C24	1.55	1.55	1.59	1.58
C23/C30	0.14	0.15	0.15	0.14
C24/C30	0.09	0.09	0.09	0.09
C29/C30	0.75	0.74	0.73	0.72
C31(S)/C31(R)	1.34	1.29	1.31	1.3
C32(S)/C32(R)	1.47	1.5	1.49	1.48
Ts/Tm	0.57	0.56	0.55	0.55
C27 $\alpha\beta$ /C29 $\alpha\beta$	0.88	0.89	0.88	0.9
Σ (C31 to C35) homohopanes	163	171	187	215
C30/ Σ (C31 to C35)	0.45	0.46	0.46	0.43

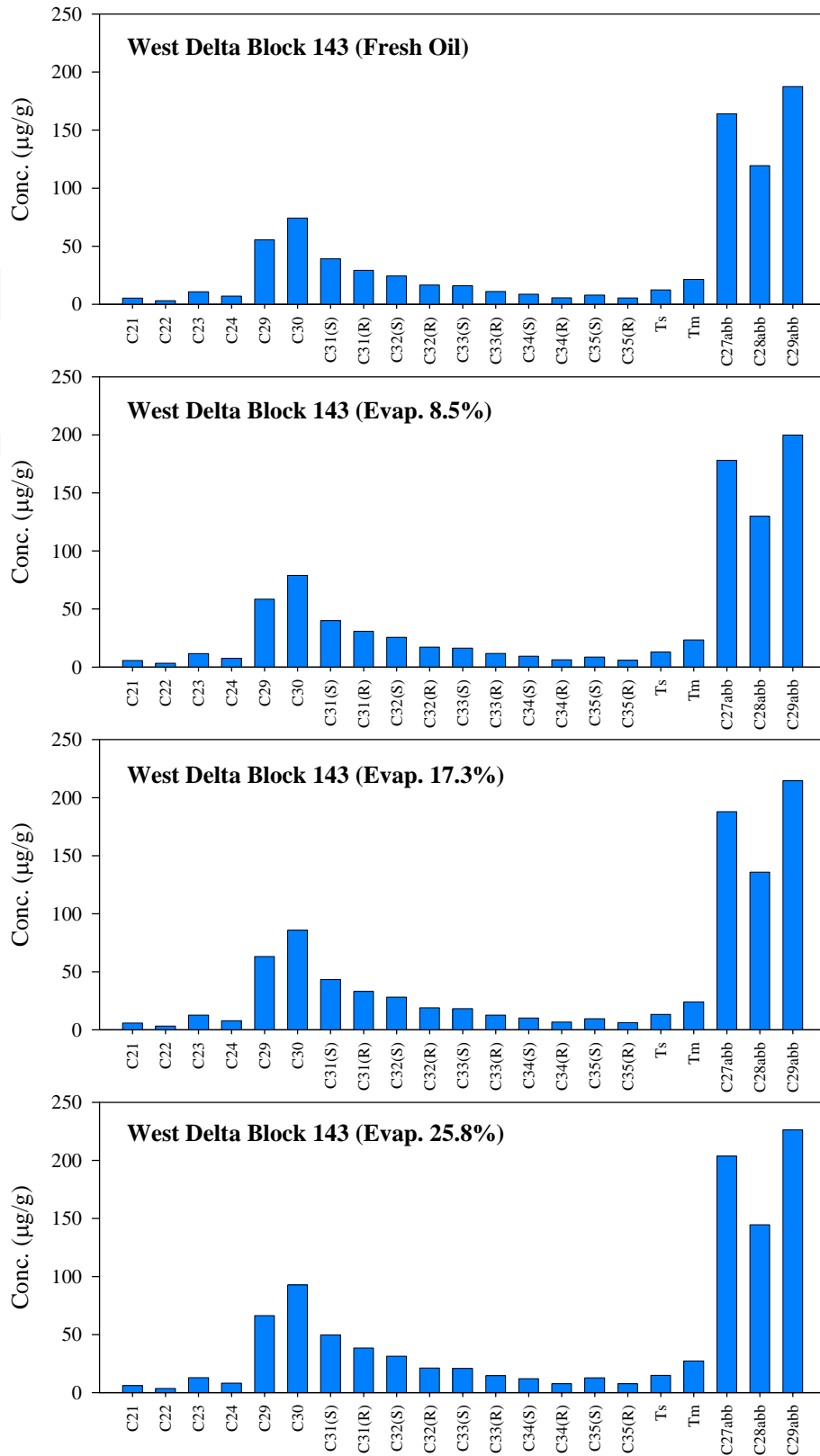


Figure 27 Biomarker Distributions for West Delta Block 143