CRC Report No. AVFL-29-2

EFFECT OF DHA DEVELOPMENT ON PMI VARIABILITY

Final Report Appendices

January 2022

COORDINATING RESEARCH COUNCIL, INC.
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Appendix I

Questionnaire for Laboratories Providing Detailed Hydrocarbon Analysis (DHA) of Gasoline Samples

1. Is the DHA method used in your lab based on a published method, such as ASTM D6729, ASTM D6730, or enhanced ASTM D6730? Are you following the prescribed method or making modifications to it?

2. What instrument (manufacturer and model) is used for analysis?

3. What software package is used to analyze the chromatograms and calculate DHA results? (For example, Dragon, Hydrocarbon Expert, or other.)

4. What is the GC column type and length? Are you using a pre-column to enhance separation of toluene?

5. What is the pre-column type and length (if any)?

6. What is the GC temperature protocol?

7. What is the carrier gas type?

8. What is the flow rate and pressure of the carrier gas? Are runs performed using constant flow or constant pressure?

9. What is the injection split ratio and injection amount?

10. What type of injector liner is used (if any)?

11. What type of detector is used – FID only or backed up by MS?

12. How are peaks identified? For example, using retention indices based on n-paraffins, indices based on a qualitative standard mix, etc.?

13. What types of post-run adjustments are made, if any? For example: manual baseline adjustments, or peak identification checks (e.g. by reviewing deviations from expected retention times)?

14. Are any unique adjustments or calculations conducted to quantify ethanol or other oxygenates?

15. Is mass spectrometry (GC-MS) used to resolved co-eluting peaks? If yes, which ones?

16. What is the approximate number of compounds per compound class that can be identified by the DHA method?
    - n-Paraffins:
    - i-Paraffins:
    - Olefins:
    - Naphthenes:
    - Aromatics:
    - Total:

17. How are unidentified peaks handled with respect to data analysis and reporting? What is the target level of unidentified peaks for a fuel sample?

18. Are relative response factors (RRFs) used to quantify species? If yes, what is the source of these RRFs?

19. Are PMI values calculated from the DHA results? If so, what is the source of PMI factors used for identified (and unidentified) species? Are you using the data provided by SSI in the ASTM D6730 PMI calculator, or some other data source for the PMI calculator?

20. What QA/QC checks are applied, and what is their frequency? For example: periodic injection of a standard mix to check retention time drift.

21. What is the latest eluting compound that can be integrated and reported? At what point in the run is peak integration turned off?

22. What is the approximate percent of components listed as “unidentified” for a typical gasoline analysis? For example: 2-6% unidentified, less than X% unidentified, etc.?

Appendix II
Compound Naming Reconciliation

Individual Laboratory Name	Consolidated Database Name
(1-ethylpropyl)benzene	benzene, (1-ethylpropyl)-
*2-ethylhexene-1	2-ethylhexene-1
1,1,3 trimethyl cyclohexane	1,1,3-trimethylcyclohexane
1,1,3-trimethyl indan	1h-indene, 2,3-dihydro-1,1,3-trimethyl-
1,1,3-trimethyl indane	1h-indene, 2,3-dihydro-1,1,3-trimethyl-
1,1,5-trimethyl indan	1h-indene, 2,3-dihydro-1,1,5-trimethyl-
1,2,3,4,5-pentamethylbenzene	pentamethylbenzene
1,2,3,4-tetrahydronaphthalene	naphthalene, 1,2,3,4-tetrahydro
1,2,3-trimethylcyclopentene	cyclopentene, 1,2,3-trimethyl-
1,2,4,5-tetramethyl-3-ethylbenze	benzene, 3-ethyl-1,2,4,5-tetramethyl-
1,2-dimethylbenzene	o-xylene
1,2-dimethylnaphthalene	naphthalene, 1,2-dimethyl-
1,2-ethyl-i-propylbenzene	1-ethyl-2-i-propylbenzene
1,2-methyl-i-propylbenzene	1-methyl-2-i-propylbenzene
1,2-methyl-n-butylbenzene	1-methyl-2-n-butylbenzene
1,2-methyl-n-propylbenzene	1-methyl-2-n-propylbenzene
1,2-methyl-t-butylbenzene	1-t-butyl-2-methylbenzene
1,2-methylethylbenzene	1-methyl-2-ethylbenzene
1,3-butadiene	1,3 butadiene
1,3-diethyl-5-methyl benzene	benzene, 1,3-diethyl-5-methyl-
1,3-dimethylnaphthalene	naphthalene, 1,3-dimethyl-
1,3-methyl-i-propylbenzene	1-methyl-3-i-propylbenzene
1,3-methyl-n-propylbenzene	1-methyl-3-n-propylbenzene

Individual Laboratory Name	Consolidated Database Name
1,3-methylethylbenzene	1-methyl-3-ethylbenzene
1,3diethyl benzene	1,3-diethylbenzene
1,4,5-trimethylnaphthalene	naphthalene, 1,4,5-trimethyl-
1,4-dimethyl-2-ethylbenzene	1,4,dimethyl-2-ethylbenzene
1,4-ethyl-i-propylbenzene	1-ethyl-4-i-propylbenzene
1,4-methyl-i-propylbenzene	1-methyl-4-i-propylbenzene
1,4-methyl-n-pentylbenzene	1-methyl-4-n-pentylbenzene
1,4-methyl-t-butylbenzene	1-methyl-4-t-butylbenzene
1,4-methylethylbenzene	1-methyl-4-ethylbenzene
1,4-pentadiene, 2,3,4-trimethy	1,4-pentadiene, 2,3,4-trimethyl-
1,6-dimethylnaphthalene	naphthalene, 1,6-dimethyl-
1,7-dimethylnaphthalene	naphthalene,1,7-dimethyl
1,8-dimethyl-1,2,3,4-tetrahydronaphthalene	naphthalene, 1,2,3,4-tetrahydro-1,8-dimethyl-
1,8-dimethylnaphthalene	naphthalene, 1,8-dimethyl-
1-c,2-t,4-trimethyl cyclopent	cyclopentane, 1,2,4-trimethyl-, (1α,2ß,4α)-
1-ethyl-2,4,5-trimethylbenzene	benzene, 1-ethyl-2,4,5-trimethyl-
1-h-indene	indene
1-isopropylnaphthalene	naphthalene, 1-propyl-
1-methyl-1-n-butylbenzene	benzene, (1-methylbutyl)-
1-methylindan	indan, 1-methyl-
1c,3-dimethylcyclohexane	1,3-dimethyl-c-cyclohexane
1c,3c,5c-trimethylcyclohexane	1c,3c,5-trimethylcyclohexane
1h-indene, 2,3-dihydro-1,2-dimethyl	1h-indene, 2,3-dihydro-1,2-dim

Individual Laboratory Name	Consolidated Database Name
1h-indene, 2,3-dihydro-1,2-dimethyl-	1h-indene, 2,3-dihydro-1,2-dim
1t,4-dimethylcyclohexane	1t,4-dimethylcyclohexane
1t-methyl-2-n-propylcyclohexane	cyclohexane, 1-isopropyl-1-methyl-
2,2,3-trimethylbutene-1	2,3,3-trimethylbutene-1
2,2-dimethylheptane	heptane, 2,2-dimethyl-
2,3,3-trimethylhexene-1	hexane, 2,3,3-trimethyl-
2,3,6-trimethylnaphthalene	naphthalene, 2,3,6-trimethyl-
2,3-dihydroindene	indan
2,3-dimethylnaphthalene	naphthalene, 2,3-dimethyl-
2,3-dimethyloctane	2,3-dimethyloctane
2,3-dimethyloctene-2	2,3-dimethyl-2-octene
2,4,4-trimethyl-1-pentene	1-pentene, 2,4,4-trimethyl-
2,4,4-trimethylhexane	hexane, 2,4,4-trimethyl-
2,4-dimethylcumene	benzene, 2,4-dimethyl-1-(1-methylethyl)-
2,4-dimethylpentene-2	2-pentene, 2,4-dimethyl-
2,5-dimethylcumene	benzene, 1,4-dimethyl-2-(1-methylethyl)-
2,5-dimethylhexene-2	2-hexene, 2,5-dimethyl-
2,5-dimethylnonane	nonane, 2,5-dimethyl-
2,6-dimethylnaphthalene	naphthalene,2,6 dimethyl
2,7-dimethylnaphthalene	naphthalene,2,7 dimethyl
2-3-dihydroindene	indan
2-methyl butane	i-pentane
2-methyl-c-hexene-3	cis-2-methyl-hexene-3
2-methyl-t-hexene-3	2-methyl-t-hexene-3
2-methylbutadiene-1,3	2-methyl-1,3-butadiene
2-methylindan(1)	2-methylindan
2-methyloctene-2	2-methyl-2-octene

Individual Laboratory Name	Consolidated Database Name
2-metyl naphthalene	2-methylnaphthalene
3 methyl pentane	3-methylpentane
3,3,5-trimethylheptane	heptane, 3,3,5-trimethyl-
3,3-dimethylheptane	heptane, 3,3-dimethyl-
3,3-dimethyloctane	octane, 3,3-dimethyl-
3,4-dimethylpentene-2	3,4-dimethylpentene-2
3,5 -dimethylheptane	3,5-dimethylheptane
3,5-dimethylcumene	benzene, 1,3-dimethyl-5-(1-methylethyl)-
3,5-dimethylhexene-2	2-hexene, 3,5-dimethyl-
3-ethyl-2,5-dimethyl-3-hexene	3-hexene, 3-ethyl-2,5-dimethyl-
3-ethyl-2-methyl-2-heptene	3-ethyl-2-methylheptene-2
3-ethylheptane	heptane, 3-ethyl-
3-methyl-indene	1h-indene, 3-methyl-
3-methylbiphenyl	1,1'-biphenyl, 3-methyl-
3-methyldecane	decane, 3-methyl-
4,7-dimethyl indan	4,7-dimethyl indane
4-ethyl-3-heptene	3-heptene, 4-ethyl-
4-methyl-3-heptene	3-heptene, 4-methyl-
4-methyl-c-pentene-2	2-pentene-cis- ,4-methyl
4-methyl-t-pentene-2	4-methyl-t-pentene-2
4-methylbiphenyl	1,1'-biphenyl, 4-methyl-
4-methyldecane	decane, 4-methyl-
4-methylpentene-1	4-methylpentene-1
4-octene, (z)-	c-octene-4
5-ethyl-1,2,3,4-tetrahydro na	naphthalene, 5-ethyl-1,2,3,4-tetrahydro-
5-methyldecane	decane, 5-methyl-
6-ethyl-1,2,3,4-tetrahydronap	naphthalene, 6-ethyl-1,2,3,4-tetrahydro-

Individual Laboratory Name	Consolidated Database Name
6-ethyltetralin	naphthalene, 6-ethyl-1,2,3,4-tetrahydro-
biphenyl	1,1'-biphenyl
c-nonene-3	cis-3-nonene
c-nonene-4	cis-4-nonene
c-octene-3	3-octene, (z)-
cyclobutane (1-methylethylidene)	cyclobutane, (1-methylethylidene)-
cyclohexane, 1,2,4-trimethyl-, (1α,2ß,4ß)-	1c,2t,4t-trimethylcyclohexane
cyclohexane, 1,3,5-trimethyl-	cyclohexane, 1,3,5-trimethyl-, (1α,3α,5ß)-
cyclohexane, 1-ethyl-3-methyl	cis-1-ethyl-3-methyl-cyclohexane
cyclohexane, 1-ethyl-4-methyl-	1-ethyl-4-methylcyclohexane
cyclohexane, butyl-	n-butylcyclohexane
cyclopentadiene	1,3-cyclopentadiene
cyclopentane, 1-ethyl-2-methyl	cyclopentane, 1-ethyl-2-methyl-
cyclopentane, 1-ethyl-2-methyl-, cis-	cyclopentane, 1-ethyl-2-methyl-cis
cyclopentane, 1-methyl-2-propyl	cyclopentane, 1-methyl-2-propyl-
diethylcylohexane	trans-1,4-diethylcyclohexane
dimethyl pentadiene	1,3-pentadiene, 2,3-dimethyl-
ethylmethyl cyclohexane	1-ethyl-3-methylcyclohexane (c,t)
ethylnaphthalene	1-ethylnaphthalene
heptane, 3,5-dimethyl-	3,5-dimethylheptane
hexane, 2,2,5-trimethyl-	2,2,5-trimethylhexane
isobutylene	isobutene
isoprene	2-methyl-1,3-butadiene
methyl cyclopantene	1-methylcyclopentene
methyl naphthalene	1-methylnaphthalene

Individual Laboratory Name	Consolidated Database Name
methyl-t-butylether	methyl-t-butyl ether
methyl-tetralin	naphthalene, 1,2,3,4-tetrahydro-1-methyl-
n dodecane	n-dodecane
n-hexadecane	hexadecane
n-pentylbenzene`	n-pentylbenzene
n-propylcyclohexane	propylcyclohexane
n-tridecane`	n-tridecane
naphthalene, 1,7-dimethyl-	naphthalene,1,7-dimethyl
naphthalene, 5-ethyl-1,2,3,4-t	naphthalene, 5-ethyl-1,2,3,4-tetrahydro-
propyl tetralin	naphthalene, 1,2,3,4-tetrahydro-6-propyl-
propylene	propene
t-1,3-pentadiene	1t,3-pentadiene
t-2-methyloctene-3	trans-2-methyl-3-octene
t-4-octene	t-octene-4
t-amylmethylether	tame
t-decalin	t-decahydronaphthalene
tetrahydronaphthalene	naphthalene, 1,2,3,4-tetrahydro
undecene-1	1-undecene
vinyl acetylene	vinyl-acetylene

Appendix III-1

DHA Weight % Results of Fuel 1 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.001							0.001	0.000
	3	0.001		0.001	0.001						0.008	0.003	0.003
	4	2.215	2.304	2.488	2.598	3.475	2.639	2.270	2.583	2.362	2.950	2.588	0.361
	5	1.059	1.146	1.154	1.191	1.511	1.192	1.150	1.221	1.167	6.854	1.764	1.700
	6	0.762	0.853	0.845	0.862	1.081	0.850	0.781	0.873	0.792	3.989	1.169	0.944
	7	0.754	1.453	1.430	1.450	1.877	1.442	1.443	1.429	1.434	1.365	1.408	0.256
	8	0.738	0.751	0.678	0.668	0.824	0.666	0.680	0.735	0.681	0.643	0.706	0.052
	9	0.267	0.231	0.230	0.219	0.280	0.232	0.226	0.239	0.238	0.267	0.243	0.020
	10	0.089	0.089	0.072	0.071	0.000	0.077	0.076	0.071	0.077	0.111	0.073	0.027
	11	0.039	0.036	0.038	0.032	0.002	0.035	0.031	0.060	0.033	0.075	0.038	0.018
	12	0.027	0.006	0.008	0.020		0.026	0.006	0.015	0.010	0.092	0.023	0.026
	13	0.004	0.002	0.001	0.001	0.000	0.053	0.004	0.042	0.049	0.246	0.040	0.072
	14	0.014	0.003				0.004	0.004		0.018	0.012	0.009	0.006
	15				0.001		0.004	0.005				0.003	0.002
	16				0.001							0.001	0.000
	Total	5.969	6.874	6.945	7.115	9.051	7.220	6.676	7.267	6.860	16.613	8.059	2.945
I	4	0.149	0.119	0.137	0.142	0.195	0.145	0.118	0.140	0.129	0.273	0.155	0.044
	5	4.932	5.285	5.269	5.499	7.045	5.524	5.207	5.653	5.284	8.888	5.859	1.147
	6	6.777	6.777	6.651	6.871	8.606	6.771	6.630	7.013	6.937	7.646	7.068	0.581
	7	9.004	8.773	8.522	8.653	10.259	8.539	8.656	8.966	8.664	5.358	8.539	1.165
	8	22.893	21.309	20.927	17.736	18.607	22.993	19.734	20.844	21.005	4.783	19.083	5.019
	9	3.701	2.967	3.370	4.079	0.270	2.860	3.222	3.448	3.310	2.073	2.930	1.021
	10	1.631	1.270	1.369	0.783	0.003	1.080	1.423	1.352	0.929	0.781	1.062	0.444
	11	1.139	1.269	0.478	1.507		1.701	0.903	0.672	0.536	0.822	1.003	0.405
	12	0.230	0.232	0.133	0.130		0.149	0.206	0.123	0.183	0.223	0.179	0.043
	13	0.106	0.006	0.004	0.031		0.061	0.023			0.031	0.037	0.033
	14		0.043									0.043	0.000
	15		0.017									0.017	0.000
	17		0.004									0.004	0.000
	Total	50.562	48.071	46.860	45.430	44.984	49.823	46.121	48.211	46.976	30.877	45.791	5.253

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.000							0.000	0.000
	3				0.001		0.002					0.001	0.001
	4	0.003	0.004	0.004	0.006		0.004	0.007	0.018		0.131	0.022	0.041
	5	2.805	3.108	3.238	2.917	3.802	3.051	3.001	3.307	3.498	2.192	3.092	0.409
	6	1.838	2.284	1.950	1.901	1.841	1.914	2.120	2.057	1.772	1.653	1.933	0.172
	7	0.677	1.040	1.117	4.136	0.000	0.744	0.674	1.158	1.146	1.333	1.203	1.043
	8	0.015	0.304	0.083	0.338	0.001	0.136	0.194	0.795	0.036	0.098	0.200	0.227
	9	0.002	0.182	0.080	0.166		0.114	0.057	0.023	0.175	0.213	0.112	0.071
	10	0.008	0.003	0.080	0.059	0.000	0.132	0.069		0.008	0.047	0.045	0.042
	11		0.020	0.025		0.001	0.029	0.044	0.021		0.016	0.022	0.012
	12		0.005	0.001	0.002				0.018		0.011	0.007	0.006
	13			0.010							0.037	0.023	0.013
	Total	5.348	6.950	6.588	9.526	5.645	6.126	6.166	7.397	6.633	5.730	6.611	1.139
N	5	0.309	0.206	0.209	0.379	0.468	0.377	0.363	0.218	0.204	0.544	0.328	0.114
	6	2.484	2.225	2.169	2.600	3.085	2.602	2.624	2.317	2.200	3.812	2.612	0.478
	7	3.014	1.696	1.759	1.890	1.961	1.548	2.260	1.908	1.716	2.370	2.012	0.411
	8	0.962	1.084	1.036	0.833	1.605	0.960	0.954	1.089	0.889	1.795	1.121	0.302
	9	0.220	0.815	0.540	0.354	0.000	0.159	0.421	0.253	0.822	1.032	0.462	0.317
	10	0.503	0.274	0.133	0.064		0.026	0.023	0.027	0.130	0.321	0.167	0.157
	11	0.279	0.139	0.014	0.007		0.005	0.010	0.162	0.167	0.023	0.090	0.094
	12		0.021	0.002					0.019		0.086	0.032	0.032
	13				0.002			0.015				0.008	0.007
	Total	7.771	6.460	5.862	6.128	7.120	5.677	6.671	5.993	6.127	9.982	6.779	1.225
A	6	0.673	0.682	0.681	0.711	0.876	0.682	0.695	0.679	0.718	0.994	0.739	0.102
	7	6.412	5.986	5.743	5.081	7.304	4.788	7.105	5.724	5.816	5.969	5.993	0.747
	8	7.412	6.953	6.759	6.718	7.489	6.948	6.701	6.484	6.568	7.874	6.991	0.431
	9	5.011	4.227	4.195	4.264	5.420	4.659	4.641	3.980	4.480	6.828	4.770	0.796
	10	2.273	2.320	2.701	2.185	1.042	2.475	2.310	2.079	2.024	4.717	2.413	0.873
	11	0.469	0.553	0.344	0.717	0.000	0.598	0.786	0.267	0.556	1.303	0.559	0.329
	12	0.254	0.298	0.201	0.235	0.000	0.403	0.284	0.302	0.434	0.449	0.286	0.124
	13		0.011		0.006			0.038				0.018	0.014
	14				0.002		0.002					0.002	0.000
	Total	22.504	21.030	20.624	19.918	22.133	20.555	22.561	19.515	20.597	28.134	21.757	2.346
X	2	7.818	10.502	11.292	11.230	11.067	10.404	11.040	10.740	10.903		10.555	1.009
	3				0.000							0.000	0.000
	4				0.001							0.001	0.000
	5								0.136			0.136	0.000
	6		0.045		0.000							0.023	0.022
	Total	7.818	10.547	11.292	11.231	11.067	10.404	11.040	10.876	10.903		10.575	1.013
U*	0	0.025	0.070	1.833	0.653		0.205	0.660	0.742	1.904	8.664	1.639	2.567
	15+							0.106				0.106	0.000
	Total	0.025	0.070	1.833	0.653	0.000	0.205	0.766	0.742	1.904	8.664	1.486	2.481
Grand Total		99.997	100.002	100.004	100.000	100.000	100.010	100.000	100.000	100.000	99.999		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-2

DHA Weight % Results of Fuel 2 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.001							0.001	0.000
	3	0.003	0.002	0.002	0.002		0.001	0.002				0.002	0.001
	4	1.398	0.911	0.864	1.010	1.189	0.896	0.942	0.862	0.998	0.965	1.003	0.160
	5	5.252	4.236	4.093	4.519	5.491	4.344	4.330	4.294	4.287	4.524	4.537	0.437
	6	2.577	2.475	2.423	2.579	3.173	2.536	2.449	2.507	2.405	2.666	2.579	0.212
	7	1.806	1.808	1.812	1.883	2.463	1.895	1.818	1.812	1.784	1.979	1.906	0.194
	8	1.087	1.151	1.160	1.189	1.440	1.169	1.150	1.347	1.130	1.244	1.207	0.103
	9	0.518	0.562	0.546	0.539	0.674	0.580	0.535	0.543	0.584	0.598	0.568	0.043
	10	0.217	0.258	0.235	0.219	0.001	0.251	0.225	0.252	0.225	0.070	0.195	0.082
	11	0.112	0.133	0.132	0.112	0.006	0.124	0.114	0.150	0.114	0.159	0.116	0.040
	12	0.000	0.067	0.079	0.094		0.083	0.073	0.076	0.072	0.119	0.074	0.030
	13	0.024	0.025	0.032	0.026	0.000	0.032	0.033		0.083	0.028	0.031	0.020
	14	0.010	0.010				0.016	0.010		0.024		0.014	0.005
	15		0.005		0.001			0.007				0.004	0.003
	16		0.004									0.004	0.000
	17		0.004									0.004	0.000
	18		0.003				0.004					0.004	0.001
	Total	13.004	11.654	11.378	12.172	14.437	11.931	11.687	11.842	11.706	12.353	12.216	0.858
I	4	0.146	0.090	0.084	0.100	0.113	0.085	0.092	0.083	0.105	0.094	0.099	0.018
	5	9.357	7.052	6.719	7.548	9.080	7.139	7.170	7.091	7.211	7.451	7.582	0.847
	6	6.944	6.056	5.871	6.301	7.715	6.158	6.023	6.137	6.208	5.382	6.280	0.603
	7	5.253	5.078	5.089	5.311	6.372	5.253	5.197	5.352	5.200	5.515	5.362	0.358
	8	6.641	7.480	7.517	6.934	7.145	7.714	6.901	6.736	7.239	7.455	7.176	0.346
	9	2.542	2.741	2.868	2.676	0.257	2.228	2.368	2.941	3.137	3.077	2.484	0.792
	10	1.159	1.729	1.575	1.124	0.001	1.146	1.263	1.731	1.801	1.267	1.280	0.496
	11	0.707	1.026	0.658	0.693		0.767	0.565	0.884	0.719	1.642	0.851	0.307
	12	0.171	0.497	0.423	0.665		0.170	0.185	0.384	0.230	0.107	0.315	0.177
	13	0.273	0.050	0.018	0.018		0.132	0.029	0.055		0.014	0.074	0.084
	14		0.113									0.113	0.000
	15		0.004									0.004	0.000
	Total	33.193	31.916	30.822	31.369	30.683	30.792	29.794	31.395	31.848	32.004	31.382	0.886

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.000	0.000							0.000	0.000
	4	0.212	0.256	0.249	0.262	0.114	0.252	0.273	0.268	0.291	0.151	0.233	0.054
	5	3.879	3.151	3.195	3.150	3.915	3.152	3.197	3.282	3.572	8.799	3.929	1.648
	6	2.047	2.435	1.965	1.965	2.192	1.999	2.124	2.114	1.820	3.363	2.202	0.417
	7	0.894	1.458	1.655	1.016	0.134	0.984	0.956	1.653	1.587	1.888	1.222	0.497
	8	0.553	0.638	0.176	0.896	0.000	0.433	0.399	1.163	0.066	0.061	0.439	0.365
	9	0.272	0.266	0.265	0.220		0.128	0.223	0.211	0.131	0.785	0.278	0.186
	10	0.021	0.077	0.048	0.122	0.000	0.260	0.107	0.080	0.054	0.080	0.085	0.068
	11		0.020	0.023	0.017	0.298		0.028	0.025		0.483	0.128	0.173
	12		0.035	0.004	0.009				0.048		0.015	0.022	0.017
	13			0.008					0.030			0.019	0.011
	Total	7.878	8.336	7.588	7.659	6.654	7.208	7.305	8.874	7.521	15.624	8.465	2.455
N	5	0.567	0.397	0.396	0.534	0.647	0.514	0.519	0.412	0.411	0.435	0.483	0.081
	6	2.720	2.223	2.148	2.713	3.222	2.684	2.674	2.282	2.172	2.350	2.519	0.325
	7	3.616	2.869	2.916	3.316	3.298	3.454	3.548	3.041	2.804	2.887	3.175	0.291
	8	2.260	2.542	2.438	2.295	0.452	2.681	2.476	2.484	2.149	1.905	2.168	0.609
	9	0.756	1.338	1.247	0.880	0.773	0.982	1.318	1.323	1.002	1.421	1.104	0.240
	10	0.847	0.323	0.256	0.332		0.605	0.088	0.231	0.277	0.359	0.369	0.213
	11	0.371	0.258	0.082	0.043		0.055	0.021	0.081	0.060	0.114	0.121	0.110
	12			0.005						0.013	0.382	0.133	0.176
	13							0.011				0.011	0.000
	Total	11.137	9.950	9.488	10.114	8.392	10.975	10.655	9.855	8.888	9.853	9.931	0.823
A	6	0.616	0.564	0.568	0.613	0.727	0.580	0.580	0.568	0.589	0.618	0.602	0.046
	7	6.117	6.156	5.953	6.276	7.713	6.124	6.646	5.933	6.383	6.427	6.373	0.493
	8	5.836	6.382	6.304	6.335	7.916	6.561	6.059	6.110	5.919	6.734	6.416	0.565
	9	7.662	8.101	7.699	8.079	9.597	8.828	8.077	7.475	7.369	8.402	8.129	0.643
	10	3.063	3.935	5.114	4.183	2.886	4.918	4.504	4.042	2.982	2.795	3.842	0.821
	11	1.211	1.487	0.782	1.556	0.692	1.360	1.662	0.975	1.170	0.882	1.178	0.321
	12	0.513	0.914	0.611	0.365	0.236	0.500	0.573	0.695	0.668	0.866	0.594	0.197
	13		0.010		0.001		0.020	0.059				0.023	0.022
	14				0.031							0.031	0.000
	Total	25.018	27.549	27.031	27.439	29.767	28.891	28.161	25.799	25.079	26.724	27.146	1.483
X	2	9.676	10.123	10.575	10.710	9.561	10.075	10.422	9.897	10.383		10.158	0.375
	3												
	4												
	5								0.104			0.104	0.000
	6		0.048									0.048	0.000
	Total	9.676	10.171	10.575	10.710	9.561	10.075	10.422	10.001	10.383		10.175	0.368
U*	0	0.097	0.420	3.110	0.537	0.506	0.133	1.858	2.235	4.575	3.442	1.691	1.518
	15+							0.118				0.118	0.000
	Total	0.097	0.420	3.110	0.537	0.506	0.133	1.975	2.235	4.575	3.442	1.703	1.520
Grand Total		100.003	99.996	99.992	100.000	100.000	100.005	100.000	100.000	100.000	100.000		

* “0” indicates unknowns of all carbon numbers; “15+” indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-3

DHA Weight % Results of Fuel 3 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.000							0.000	0.000
	3	0.000		0.001	0.001						0.001	0.001	0.000
	4	0.375	0.273	0.240	0.244	0.339	0.265	0.266	0.257	0.210	0.279	0.275	0.046
	5	3.401	2.742	2.580	2.748	3.498	2.821	2.745	2.669	2.492	2.974	2.867	0.317
	6	2.631	2.456	2.393	2.551	3.161	2.547	2.405	2.371	2.333	2.727	2.557	0.233
	7	0.761	1.486	1.490	1.575	2.040	1.548	1.499	1.404	1.493	1.678	1.497	0.298
	8	0.691	0.754	0.746	0.740	0.911	0.709	0.732	0.671	0.749	0.817	0.752	0.065
	9	0.342	0.362	0.350	0.350	0.419	0.360	0.346	0.320	0.375	0.400	0.362	0.027
	10	0.172	0.192	0.179	0.173	0.001	0.184	0.167	0.298	0.179	0.061	0.161	0.075
	11	0.100	0.118	0.115	0.107	0.005	0.115	0.096	0.184	0.106	0.133	0.108	0.042
	12	0.051	0.075	0.067	0.115		0.069	0.077	0.063	0.075	0.140	0.081	0.026
	13	0.056	0.063	0.047	0.043	0.001	0.055	0.059		0.272	0.249	0.094	0.091
	14	0.011	0.021				0.043	0.019		0.072	0.017	0.031	0.021
	15		0.003		0.000		0.003	0.004				0.003	0.001
	16				0.002							0.002	0.000
	17												
	18												
	Total	8.591	8.545	8.208	8.649	10.375	8.719	8.416	8.235	8.355	9.475	8.757	0.638
I	4	0.059	0.044	0.036	0.035		0.040	0.040	0.039	0.030	0.042	0.041	0.008
	5	9.315	7.308	6.682	7.150	9.179	7.373	7.204	7.077	6.392	7.744	7.542	0.922
	6	9.206	7.844	7.588	8.113	10.065	8.145	7.918	3.760	7.711	8.419	7.877	1.551
	7	6.596	6.206	6.185	6.522	7.851	6.380	6.296	6.153	6.302	6.868	6.536	0.486
	8	4.219	4.384	4.545	3.998	4.621	4.472	4.427	3.490	4.822	4.942	4.392	0.396
	9	2.103	2.487	2.544	2.381	0.321	1.953	2.191	2.248	3.095	2.743	2.206	0.702
	10	0.809	1.406	1.484	1.146	0.001	0.927	1.346	2.974	1.832	1.185	1.311	0.724
	11	0.527	0.971	0.639	0.486		0.522	0.510	1.410	0.732	0.421	0.691	0.299
	12	0.147	0.703	0.664	0.274		0.157	0.123	0.519	0.475	0.213	0.364	0.216
	13	0.139	0.119	0.041	0.055		0.202	0.059	0.171		0.045	0.104	0.059
	14		0.331									0.331	0.000
	15		0.026									0.026	0.000
	16												
	17		0.004									0.004	0.000
	Total	33.120	31.833	30.408	30.159	32.038	30.171	30.115	27.840	31.391	32.620	30.969	1.468

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.000							0.000	0.000
	3			0.000	0.001							0.001	0.001
	4	0.121	0.090	0.080	0.072		0.084	0.090	0.299	0.073	0.092	0.111	0.068
	5	3.375	2.844	2.805	2.611	3.388	2.888	2.765	2.824	2.951	2.649	2.910	0.255
	6	2.064	2.183	1.861	1.833	1.950	1.874	1.939	5.502	1.459	2.459	2.312	1.091
	7	0.914	1.578	1.519	1.150	0.001	1.012	1.027	1.449	1.612	1.783	1.205	0.490
	8	0.264	0.508	0.158	0.985	0.275	0.296	0.338	1.115	0.069	0.134	0.414	0.339
	9	0.134	0.208	0.230	0.192		0.141	0.183	0.159	0.107	0.252	0.178	0.045
	10		0.032	0.025	0.150	0.000	0.257	0.111	0.186	0.053	0.087	0.100	0.080
	11		0.028	0.025	0.008	0.001		0.022	0.064		0.022	0.024	0.018
	12		0.061	0.006	0.029		0.021				0.018	0.027	0.019
	13		0.007	0.008					0.050		0.054	0.030	0.022
	Total	6.872	7.539	6.717	7.031	5.616	6.573	6.474	11.648	6.324	7.549	7.234	1.568
N	5	0.517	0.317	0.311	0.479	0.594	0.483	0.461	0.313	0.304	0.354	0.413	0.100
	6	2.807	2.303	2.248	2.775	3.296	2.780	2.707	2.288	2.252	2.543	2.600	0.322
	7	4.240	2.691	2.983	3.184	3.350	3.450	3.463	2.917	2.696	2.975	3.195	0.439
	8	2.392	2.185	2.330	2.059	0.332	2.458	2.533	2.590	2.153	2.346	2.138	0.623
	9	0.948	1.131	1.134	0.846	0.000	0.903	1.264	1.183	0.945	1.361	0.972	0.360
	10	1.219	0.266	0.313	0.399		0.187	0.086	0.835	0.124	0.762	0.466	0.365
	11	0.384	0.243	0.059	0.074		0.007	0.021	0.253	0.018		0.132	0.132
	12		0.108	0.006						0.016	0.105	0.059	0.048
	13				0.006		0.008	0.010				0.008	0.002
	Total	12.507	9.244	9.384	9.820	7.572	10.276	10.545	10.379	8.509	10.445	9.868	1.262
A	6	1.972	1.808	1.782	1.945	2.351	1.854	1.800	1.697	2.000	1.985	1.919	0.173
	7	6.111	6.194	6.107	6.538	7.960	6.236	6.317	5.708	6.185	6.728	6.408	0.577
	8	7.881	8.589	8.526	8.807	10.823	8.617	8.275	7.687	8.353	9.272	8.683	0.830
	9	6.765	7.259	6.918	7.405	9.273	7.688	6.991	6.860	6.838	7.791	7.379	0.719
	10	3.856	4.579	5.576	4.809	3.180	5.468	5.118	5.187	3.413	5.176	4.636	0.816
	11	1.443	1.997	1.236	2.449	0.948	2.648	2.704	1.488	1.396	1.622	1.793	0.588
	12	1.254	1.831	0.972	1.005	0.302	1.227	1.296	0.847	0.983	0.608	1.032	0.394
	13		0.018		0.050		0.058	0.125				0.063	0.039
	14				0.004							0.004	0.000
	15				0.000							0.000	0.000
	Total	29.282	32.275	31.117	33.014	34.837	33.796	32.625	29.473	29.168	33.180	31.877	1.913
X	2	9.596	10.051	10.274	10.310	9.562	10.244	10.162	9.231	9.834		9.918	0.361
	3				0.000							0.000	0.000
	4				0.001							0.001	0.000
	5								0.103			0.103	0.000
	6		0.046									0.046	0.000
	Total	9.596	10.097	10.274	10.311	9.562	10.244	10.162	9.334	9.834		9.935	0.342
U*	0	0.031	0.464	3.890	1.015		0.211	1.557	3.092	6.420	6.730	2.601	2.450
	15+							0.106				0.106	0.000
	Total	0.031	0.464	3.890	1.015	0.000	0.211	1.663	3.092	6.420	6.730	2.352	2.449
Grand Total		99.999	99.997	99.998	100.000	100.000	99.990	100.000	100.000	100.000	100.000		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-4

DHA Weight % Results of Fuel 4 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1												
	3	0.001		0.001	0.001		0.001				0.001	0.001	0.000
	4	0.404	0.286	0.312	0.349	0.387	0.318	0.325	0.346	0.343	0.330	0.340	0.033
	5	3.542	2.970	2.990	3.234	3.825	3.134	3.081	3.223	3.097	3.210	3.230	0.250
	6	2.931	2.824	2.778	2.952	3.557	2.893	2.755	2.910	2.761	2.999	2.936	0.222
	7	0.957	1.894	1.871	1.956	2.453	1.920	1.875	1.884	1.864	2.015	1.869	0.347
	8	1.077	1.135	1.086	1.110	1.318	1.106	1.084	1.248	1.077	1.176	1.142	0.078
	9	0.562	0.575	0.557	0.574	0.670	0.570	0.553	0.558	0.585	0.604	0.581	0.033
	10	0.233	0.265	0.233	0.223	0.001	0.245	0.228	0.248	0.229	0.069	0.197	0.083
	11	0.105	0.120	0.121	0.110	0.007	0.126	0.103	0.100	0.103	0.131	0.103	0.034
	12	0.071	0.083	0.083	0.130		0.086	0.082	0.077	0.078	0.149	0.093	0.025
	13	0.052	0.050	0.050	0.047	0.001	0.062	0.055		0.140	0.049	0.056	0.034
	14	0.013	0.021				0.035	0.016		0.060	0.016	0.027	0.016
	15		0.010		0.009		0.007	0.009				0.009	0.001
	16		0.008									0.008	0.000
	17		0.004									0.004	0.000
	18		0.003				0.042					0.023	0.020
	Total	9.948	10.248	10.082	10.696	12.219	10.545	10.165	10.593	10.337	10.747	10.558	0.609
I	4	0.076	0.051	0.057	0.066	0.068	0.058	0.060	0.065	0.066	0.060	0.063	0.007
	5	6.897	5.511	5.544	6.092	7.102	5.819	5.746	6.093	5.829	5.953	6.059	0.508
	6	7.992	6.973	6.900	7.374	8.811	7.203	6.975	3.502	7.261	7.156	7.015	1.296
	7	6.580	6.242	6.170	6.425	7.592	6.246	6.273	6.549	6.335	6.437	6.485	0.391
	8	4.830	4.885	4.993	4.383	4.945	5.030	4.900	3.977	5.233	5.405	4.858	0.387
	9	2.291	2.459	2.518	2.444	0.004	2.008	2.281	2.635	2.956	2.560	2.216	0.774
	10	0.867	1.464	1.481	1.046	0.001	0.992	1.430	1.668	1.856	1.241	1.205	0.497
	11	0.526	0.828	0.507	0.432		0.529	0.406	0.864	0.606	0.988	0.632	0.197
	12	0.192	0.485	0.414	0.287		0.192	0.128	0.359	0.302	0.107	0.274	0.123
	13	0.147	0.063	0.033	0.050		0.159	0.036	0.126		0.008	0.078	0.054
	14		0.113									0.113	0.000
	15		0.004									0.004	0.000
	16		0.003									0.003	0.000
	17		0.034									0.034	0.000
	18		0.014									0.014	0.000
	Total	30.398	29.129	28.617	28.598	28.524	28.236	28.235	25.837	30.442	29.915	28.793	1.272

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.000							0.000	0.000
	3				0.000							0.000	0.000
	4	0.409	0.295	0.323	0.333	0.327	0.321	0.338	0.369	0.355	0.338	0.341	0.029
	5	3.625	2.938	3.067	2.985	3.660	3.012	3.019	2.434	3.432	3.514	3.169	0.364
	6	2.532	2.608	2.195	2.334	2.565	2.338	2.468	5.814	2.047	2.802	2.770	1.035
	7	1.392	1.685	2.023	1.527	0.411	1.496	1.369	2.089	1.832	2.158	1.598	0.481
	8	0.498	0.536	0.218	0.693	0.001	0.586	0.531	1.386	0.106	0.090	0.464	0.383
	9	0.274	0.278	0.304	0.323		0.216	0.285	0.306	0.072	0.421	0.275	0.088
	10	0.011	0.013	0.061	0.158	0.001	0.268	0.097	0.059	0.061	0.074	0.080	0.076
	11		0.028	0.023		0.001		0.021	0.014		0.020	0.018	0.009
	12		0.006	0.014	0.011		0.016		0.044		0.011	0.017	0.013
	13			0.009					0.021		0.020	0.017	0.006
	Total	8.741	8.387	8.237	8.365	6.964	8.253	8.128	12.536	7.905	9.447	8.696	1.410
N	5	0.336	0.237	0.238	0.342	0.400	0.331	0.324	0.250	0.244	0.257	0.296	0.054
	6	2.022	1.667	1.643	2.077	2.411	2.047	2.030	1.765	1.669	1.764	1.910	0.236
	7	3.490	1.915	2.016	2.402	2.260	2.395	2.537	2.144	1.943	1.841	2.294	0.457
	8	2.109	1.953	2.061	1.845	0.331	1.917	2.007	2.124	1.716	2.323	1.839	0.527
	9	1.043	1.114	1.061	0.772	1.138	0.875	1.069	1.227	0.894	0.926	1.012	0.133
	10	1.059	0.267	0.256	0.294		0.212	0.065	0.167	0.254	0.306	0.320	0.271
	11	0.258	0.259	0.059	0.060		0.011	0.022	0.075	0.022	0.009	0.086	0.095
	12		0.047	0.004						0.017	0.090	0.040	0.033
	13				0.002		0.008	0.015				0.008	0.005
	Total	10.317	7.459	7.338	7.793	6.541	7.796	8.069	7.752	6.757	7.516	7.734	0.972
A	6	0.389	0.357	0.366	0.391	0.462	0.369	0.361	0.368	0.372	0.390	0.383	0.029
	7	6.702	6.955	6.691	7.126	8.523	6.817	6.901	6.684	6.689	7.164	7.025	0.527
	8	8.076	8.679	8.321	8.510	10.387	8.471	8.168	8.178	8.002	8.856	8.565	0.660
	9	10.272	10.743	10.049	10.453	11.952	11.008	10.118	9.880	9.537	10.962	10.497	0.660
	10	3.950	4.599	5.311	4.589	3.038	5.263	5.170	3.725	3.322	4.637	4.361	0.772
	11	1.227	1.391	0.762	1.714	0.816	1.766	1.846	0.929	1.184	1.143	1.278	0.373
	12	0.877	1.011	0.865	0.687	0.351	0.752	0.774	0.835	0.672	0.623	0.745	0.170
	13		0.084		0.018		0.039	0.092				0.058	0.031
	14		0.002		0.013		0.026					0.014	0.010
	15				0.001							0.001	0.000
	Total	31.493	33.821	32.365	33.502	35.530	34.511	33.430	30.599	29.778	33.774	32.880	1.705
X	2	8.988	10.229	10.452	10.390	8.833	10.366	10.121	9.767	10.227		9.930	0.578
	3												
	4				0.001							0.001	0.000
	5								0.114			0.114	0.000
	6		0.041									0.041	0.000
	Total	8.988	10.270	10.452	10.391	8.833	10.366	10.121	9.882	10.227		9.948	0.578
U*	0	0.104	0.680	2.904	0.656	1.389	0.296	1.501	2.802	4.553	8.600	2.348	2.470
	15+							0.350				0.350	0.000
	Total	0.104	0.680	2.904	0.656	1.389	0.296	1.851	2.802	4.553	8.600	2.383	2.460
Grand Total		99.989	99.994	99.995	100.000	100.000	100.003	100.000	100.001	99.999	100.001		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-5

DHA Weight % Results of Fuel 5 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2			0.000								0.000	0.000
	3	0.005	0.004	0.003	0.003		0.002	0.003			0.004	0.003	0.001
	4	2.418	1.548	1.490	1.556	1.950	1.089	1.444	1.536	0.915	1.654	1.560	0.394
	5	5.382	3.943	3.827	4.098	5.005	3.291	3.922	4.101	3.488	4.181	4.124	0.602
	6	1.792	1.598	1.592	1.671	2.052	1.481	1.591	1.664	1.583	1.721	1.674	0.150
	7	0.831	0.870	0.890	0.908	1.189	0.887	0.893	0.888	0.922	0.954	0.923	0.094
	8	0.339	0.361	0.399	0.379	0.450	0.416	0.387	0.452	0.415	0.420	0.402	0.035
	9	0.118	0.152	0.149	0.139		0.165	0.145	0.138	0.163	0.159	0.148	0.014
	10	0.077	0.104	0.087	0.076	0.000	0.102	0.083	0.079	0.095	0.090	0.079	0.028
	11	0.032	0.051	0.067	0.052	0.001	0.061	0.050	0.057	0.059	0.069	0.050	0.019
	12	0.009	0.018	0.023	0.027		0.023	0.022	0.020	0.022	0.035	0.022	0.006
	13		0.006	0.007	0.005	0.000	0.010	0.009		0.030	0.006	0.009	0.008
	14		0.006				0.005	0.004		0.016	0.004	0.007	0.005
	15		0.003				0.003	0.005				0.004	0.001
	16		0.002									0.002	0.000
	17		0.002									0.002	0.000
	18		0.001									0.001	0.000
	Total	11.003	8.669	8.534	8.915	10.646	7.535	8.558	8.935	7.708	9.295	8.980	1.056
I	4	0.235	0.148	0.143	0.144	0.183	0.106	0.132	0.144	0.071	0.159	0.147	0.041
	5	10.354	7.236	6.922	7.438	9.074	6.111	7.066	7.507	6.023	7.602	7.533	1.238
	6	7.285	5.772	5.723	6.086	7.391	5.456	5.852	6.090	5.862	5.368	6.088	0.662
	7	4.303	4.105	4.149	4.302	4.973	4.140	4.233	4.400	4.374	4.386	4.337	0.235
	8	14.196	17.389	17.570	9.445	12.467	19.196	16.051	17.735	17.955	18.648	16.065	2.952
	9	1.776	1.891	2.292	2.610	0.001	2.199	1.953	2.362	2.282	2.282	1.965	0.695
	10	0.632	0.909	1.044	0.456	0.341	0.753	0.935	1.007	0.935	0.745	0.776	0.225
	11	0.566	1.121	0.532	1.234		1.630	0.809	0.438	0.539	0.625	0.833	0.384
	12	0.059	0.243	0.160	0.231		0.212	0.201	0.133	0.157	0.030	0.158	0.070
	13	0.038	0.002	0.004	0.032		0.343	0.013	0.022		0.005	0.057	0.109
	14		0.017									0.017	0.000
	15		0.016									0.016	0.000
	16		0.002									0.002	0.000
	17		0.001									0.001	0.000
	18		0.001									0.001	0.000
	Total	39.444	38.853	38.539	31.978	34.429	40.146	37.246	39.837	38.199	39.850	37.852	2.528

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.000							0.000	0.000
	3		0.001	0.001	0.000						0.001	0.001	0.000
	4	0.124	0.145	0.144	0.134		0.095	0.142	0.139	0.093	0.157	0.130	0.021
	5	2.709	2.018	2.043	1.909	2.396	1.681	1.958	2.101	2.091	2.975	2.188	0.373
	6	1.471	1.490	1.316	1.292	1.105	1.190	1.408	1.442	1.211	1.708	1.363	0.168
	7	0.440	1.059	0.878	0.595	0.001	0.511	0.522	0.843	0.883	1.294	0.703	0.347
	8	2.339	0.491	0.098	0.265	0.002	0.077	0.188	0.452	0.040	0.023	0.398	0.668
	9	0.005	0.286	0.101	0.191		0.067	0.065	0.022	0.121	0.213	0.119	0.088
	10	0.070	0.007	0.058	0.031	0.000	0.212	0.061		0.014	0.123	0.064	0.064
	11		0.019	0.026		0.000	0.032	0.039	0.024		0.086	0.032	0.024
	12		0.008	0.004							0.002	0.005	0.002
	13			0.006							0.005	0.006	0.000
	Total	7.158	5.524	4.675	4.419	3.504	3.865	4.383	5.023	4.454	6.587	4.959	1.099
N	5	0.462	0.311	0.311	0.412	0.498	0.339	0.360	0.329	0.299	0.337	0.366	0.065
	6	1.860	1.454	1.454	1.800	2.137	1.632	1.788	1.569	1.492	1.566	1.675	0.208
	7	1.513	1.277	1.281	9.692	1.132	1.507	1.707	1.375	1.334	1.026	2.184	2.509
	8	0.597	1.054	0.856	0.554	1.211	0.896	0.941	0.900	0.840	0.911	0.876	0.183
	9	0.077	0.869	0.486	0.182	0.000	0.404	0.444	0.324	0.682	0.471	0.394	0.251
	10	0.261	0.224	0.134	0.115		0.061	0.035	0.100	0.119	0.215	0.141	0.072
	11	0.167	0.129	0.014	0.037			0.010	0.162	0.173	0.010	0.088	0.072
	12			0.002						0.005	0.026	0.011	0.011
	13							0.015				0.015	0.000
	Total	4.937	5.318	4.538	12.792	4.979	4.839	5.301	4.759	4.944	4.562	5.697	2.378
A	6	0.476	0.429	0.436	0.462	0.553	0.386	0.446	0.436	0.463	0.466	0.455	0.041
	7	10.084	10.447	10.327	10.252	13.367	9.680	11.914	10.322	10.941	11.014	10.835	1.026
	8	10.390	12.297	12.431	12.407	15.857	13.625	12.362	12.101	12.776	13.066	12.731	1.307
	9	4.041	5.069	5.110	5.036	6.295	6.208	5.340	4.802	5.434	5.396	5.273	0.619
	10	1.326	2.095	2.640	2.045	0.796	2.510	2.291	2.525	2.074	2.639	2.094	0.572
	11	0.234	0.440	0.272	0.539	0.000	0.743	0.723	0.246	0.565	0.426	0.419	0.222
	12	0.069	0.253	0.254	0.094	0.000	0.225	0.214	0.200	0.362	0.118	0.179	0.102
	13		0.010		0.040			0.035				0.028	0.013
	14												
	15												
	Total	26.620	31.040	31.470	30.875	36.868	33.377	33.325	30.631	32.614	33.125	31.995	2.496
X	2	10.787	10.202	10.599	10.690	9.574	10.039	10.421	10.041	10.244		10.289	0.360
	3												
	4												
	5								0.092			0.092	0.000
	6		0.028									0.028	0.000
	Total	10.787	10.230	10.599	10.690	9.574	10.039	10.421	10.134	10.244		10.302	0.353
U*	0	0.047	0.358	1.651	0.332	0.000	0.201	0.639	0.681	1.839	6.582	1.233	1.881
	15+							0.127				0.127	0.000
	Total	0.047	0.358	1.651	0.332	0.000	0.201	0.766	0.681	1.839	6.582	1.246	1.877
Grand Total		99.996	99.992	100.006	100.000	100.000	100.002	100.000	100.001	100.000	100.001		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-6

DHA Weight % Results of Fuel 6a by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2								0.021			0.021	0.000
	3	0.043	0.016	0.011	0.019		0.002	0.019		0.018	0.009	0.017	0.011
	4	6.574	3.599	3.036	3.936	0.386	1.665	3.709	3.834	3.558	3.103	3.340	1.516
	5	9.009	6.950	6.456	7.245	3.815	5.235	6.925	7.093	6.714	6.937	6.638	1.282
	6	3.751	3.749	3.658	3.873	3.541	3.506	3.687	3.756	3.649	3.988	3.716	0.136
	7	0.541	1.225	1.256	1.279	2.444	1.333	1.229	1.212	1.221	1.359	1.310	0.438
	8	0.462	0.642	0.601	0.574	1.332	0.659	0.552	0.548	0.579	0.637	0.659	0.231
	9	0.175	0.245	0.239	0.228	0.674	0.290	0.232	0.248	0.245	0.266	0.284	0.133
	10	0.079	0.116	0.107	0.091	0.001	0.133	0.098	0.134	0.101	0.110	0.097	0.036
	11	0.025	0.053	0.059	0.048	0.007	0.080	0.043	0.049	0.048	0.067	0.048	0.019
	12	0.010	0.023	0.024	0.072		0.099	0.034	0.030	0.032	0.093	0.046	0.031
	13	0.005	0.024	0.018	0.020	0.001	0.029	0.028		0.232	0.239	0.066	0.091
	14		0.022				0.081	0.015		0.116	0.012	0.049	0.042
	15		0.004		0.007		0.003	0.014				0.007	0.004
	16												
	17												
	18												
	Total	20.674	16.668	15.465	17.390	12.202	13.115	16.587	16.924	16.513	16.818	16.236	2.210
I	4	0.739	0.358	0.292	0.408	0.066	0.148	0.381	0.401	0.371	0.292	0.346	0.169
	5	13.454	9.274	8.412	9.699	7.083	6.830	9.227	9.522	8.984	9.057	9.154	1.709
	6	8.535	7.376	7.158	7.666	8.785	6.949	7.195	7.339	7.347	7.659	7.601	0.570
	7	4.977	4.957	5.021	5.148	7.231	5.229	4.989	5.137	5.011	5.339	5.304	0.653
	8	3.921	3.958	4.492	3.881	4.941	4.928	4.048	3.830	4.355	4.693	4.305	0.415
	9	1.326	1.575	2.000	1.720	0.186	1.826	1.611	1.879	2.278	2.039	1.644	0.549
	10	0.480	1.027	1.058	0.661	0.001	0.812	0.965	1.248	1.318	0.767	0.834	0.369
	11	0.205	0.655	0.453	0.322		0.585	0.342	0.800	0.540	0.817	0.524	0.201
	12	0.040	0.480	0.489	0.215		0.141	0.081	0.411	0.348	0.223	0.270	0.159
	13	0.042	0.070	0.023	0.036		0.165	0.047	0.105		0.032	0.065	0.045
	14		0.175									0.175	0.000
	15		0.023									0.023	0.000
	16		0.005									0.005	0.000
	17		0.013									0.013	0.000
	18		0.001									0.001	0.000
	Total	33.719	29.947	29.398	29.756	28.295	27.613	28.886	30.672	30.552	30.917	29.975	1.603

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3												
	4	0.179	0.155	0.138	0.156	0.324	0.069	0.165	0.208	0.164	0.137	0.170	0.062
	5	2.734	1.985	1.982	1.905	3.570	1.418	1.945	1.660	2.284	2.215	2.170	0.575
	6	1.379	1.497	1.296	1.215	2.551	1.112	1.439	1.312	0.968	1.655	1.442	0.413
	7	0.516	1.182	1.126	0.766	0.406	0.934	0.727	1.114	1.199	1.372	0.934	0.303
	8	0.364	0.737	0.145	0.634	0.001	0.149	0.301	0.945	0.059	0.052	0.339	0.310
	9	0.050	0.190	0.186	0.139		0.168	0.148	0.148	0.085	0.228	0.149	0.051
	10	0.013	0.007	0.028	0.059	0.001	0.252	0.079	0.033	0.039	0.046	0.056	0.069
	11		0.019	0.017		0.000		0.020	0.041		0.018	0.019	0.012
	12		0.005	0.012	0.002		0.013				0.011	0.009	0.004
	13			0.009					0.039		0.037	0.028	0.014
	Total	5.235	5.777	4.939	4.876	6.852	4.115	4.824	5.502	4.798	5.771	5.269	0.713
N	5	0.714	0.521	0.509	0.659	0.401	0.515	0.633	0.538	0.522	0.548	0.556	0.085
	6	3.830	3.565	3.503	3.993	2.396	3.698	3.853	3.683	3.496	3.810	3.583	0.424
	7	3.153	2.193	2.470	2.648	2.261	2.756	2.836	2.488	2.191	2.368	2.536	0.297
	8	1.258	1.557	1.848	1.438	0.002	2.246	1.937	2.172	1.578	1.798	1.583	0.605
	9	0.335	1.236	0.843	0.580	1.123	0.943	0.930	0.902	0.708	0.801	0.840	0.245
	10	0.566	0.211	0.205	0.155		0.129	0.060	0.164	0.088	0.312	0.210	0.144
	11	0.265	0.212	0.043	0.036		0.003	0.012	0.050	0.024	0.023	0.074	0.090
	12		0.070	0.003						0.011	0.086	0.042	0.036
	13							0.007				0.007	0.000
	Total	10.121	9.565	9.424	9.508	6.183	10.290	10.269	9.998	8.618	9.745	9.372	1.164
A	6	0.953	0.920	0.924	0.987	0.460	0.841	0.933	0.901	1.094	0.990	0.900	0.160
	7	4.893	5.526	5.555	5.740	8.510	5.838	5.796	5.335	5.618	5.954	5.876	0.923
	8	5.537	7.231	7.389	7.262	10.373	8.535	7.018	6.806	6.927	7.790	7.487	1.202
	9	4.648	6.390	6.222	6.292	11.950	8.249	6.142	5.756	5.849	6.724	6.822	1.909
	10	2.325	3.887	4.717	3.918	3.186	5.096	4.231	3.408	2.668	4.644	3.808	0.862
	11	0.612	1.503	1.037	1.892	0.821	2.809	2.113	0.984	1.115	1.301	1.419	0.640
	12	0.964	1.316	0.791	0.927	0.350	1.726	1.077	0.759	0.701	0.447	0.906	0.383
	13		0.064		0.019		0.119	0.089				0.073	0.037
	14				0.002		0.010					0.006	0.004
	15												
	Total	19.932	26.837	26.635	27.040	35.649	33.223	27.398	23.949	23.972	27.850	27.248	4.271
X	2	10.299	10.873	11.091	11.000	9.982	11.453	10.640	9.975	10.696		10.668	0.476
	3												
	4												
	5								0.076			0.076	0.000
	6		0.036									0.036	0.000
	Total	10.299	10.909	11.091	11.000	9.982	11.453	10.640	10.051	10.696		10.680	0.466
U*	0	0.017	0.306	3.054	0.429	0.838	0.187	1.207	2.905	4.853	8.899	2.269	2.673
	15+							0.189				0.189	0.000
	Total	0.017	0.306	3.054	0.429	0.838	0.187	1.396	2.905	4.853	8.899	2.288	2.666
Grand Total		99.997	100.009	100.006	100.000	100.000	99.996	100.000	100.000	100.000	100.000		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-7

DHA Weight % Results of Fuel 6b by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2								0.010			0.010	0.000
	3	0.035	0.015	0.013	0.013		0.002	0.019		0.012		0.016	0.009
	4	6.593	3.563	3.220	3.525		1.597	3.728	3.091	3.174	3.507	3.555	1.228
	5	9.641	7.028	6.496	7.157		5.294	6.936	6.789	6.583	7.203	7.014	1.076
	6	3.922	3.808	3.638	3.933		3.558	3.681	3.789	3.671	4.037	3.782	0.150
	7	0.512	1.242	1.245	1.305		1.329	1.226	1.239	1.236	1.370	1.189	0.244
	8	0.424	0.576	0.596	0.575		0.666	0.530	0.569	0.588	0.644	0.574	0.065
	9	0.162	0.250	0.238	0.216		0.285	0.232	0.233	0.248	0.266	0.237	0.033
	10	0.070	0.111	0.107	0.092		0.128	0.097	0.123	0.103	0.110	0.105	0.016
	11	0.023	0.058	0.047	0.048		0.080	0.043	0.072	0.049	0.066	0.054	0.016
	12	0.042	0.021	0.021	0.072		0.079	0.034	0.030	0.033	0.091	0.047	0.025
	13	0.029	0.018	0.018			0.026	0.028		0.235	0.247	0.086	0.098
	14	0.024	0.019				0.083	0.015		0.121	0.012	0.046	0.042
	15		0.002		0.010		0.004	0.004				0.005	0.003
	16						0.002					0.002	0.000
	17						0.002					0.002	0.000
	18												
	Total	21.477	16.711	15.639	16.947		13.135	16.574	15.944	16.053	17.552	16.670	2.067
I	4	0.808	0.351	0.320	0.342		0.132	0.384	0.290	0.313	0.349	0.365	0.171
	5	14.045	9.344	8.527	9.448		6.760	9.250	8.965	8.690	9.498	9.392	1.827
	6	8.667	7.489	7.129	7.732		6.995	7.361	7.498	7.362	7.778	7.557	0.459
	7	4.590	5.037	4.981	5.219		5.200	4.970	5.247	5.066	5.377	5.076	0.214
	8	3.112	4.287	4.459	3.947		4.886	4.049	3.907	4.417	4.792	4.206	0.505
	9	1.109	1.529	1.945	1.760		1.741	1.612	1.948	2.325	2.062	1.781	0.329
	10	0.418	0.954	1.041	0.679		0.882	0.980	1.079	1.326	0.727	0.899	0.248
	11	0.196	0.609	0.451	0.311		0.549	0.321	0.477	0.556	0.716	0.465	0.155
	12	0.033	0.390	0.491	0.232		0.133	0.086	0.444	0.356	0.220	0.265	0.154
	13	0.025	0.046	0.014	0.029		0.178	0.045	0.120		0.031	0.061	0.054
	14		0.198									0.198	0.000
	15		0.024									0.024	0.000
	16		0.005									0.005	0.000
	17		0.012									0.012	0.000
	18		0.003									0.003	0.000
	Total	33.003	30.278	29.358	29.699		27.456	29.058	29.975	30.411	31.548	30.087	1.470

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.000								0.000	0.000
	4	0.179	0.153	0.145	0.140		0.068	0.165	0.134	0.147	0.141	0.141	0.029
	5	2.834	2.016	1.997	1.881		1.433	1.944	2.047	2.244	2.298	2.077	0.355
	6	1.335	1.525	1.288	1.232		1.129	1.292	1.475	0.971	1.626	1.319	0.191
	7	0.485	0.993	1.158	0.880		0.831	0.729	1.168	1.216	1.268	0.970	0.246
	8	0.192	0.433	0.133	0.680		0.245	0.299	0.927	0.060		0.371	0.277
	9	0.061	0.362	0.224	0.108		0.171	0.145	0.084	0.084	0.178	0.157	0.088
	10	0.012		0.024	0.044		0.246	0.066		0.040	0.057	0.070	0.074
	11		0.022	0.017				0.017	0.015			0.018	0.003
	12		0.032	0.008	0.009		0.018				0.010	0.015	0.009
	13								0.029		0.036	0.032	0.004
	Total	5.098	5.536	4.994	4.974		4.141	4.657	5.880	4.763	5.612	5.073	0.507
N	5	0.769	0.528	0.509	0.657		0.527	0.619	0.530	0.520	0.562	0.580	0.082
	6	3.913	3.616	3.485	4.048		3.730	3.858	3.730	3.521	3.853	3.750	0.176
	7	3.053	2.230	2.448	2.587		2.934	2.828	2.535	2.216	2.392	2.580	0.283
	8	1.143	1.529	1.811	1.516		2.253	1.987	2.170	1.605	1.794	1.756	0.331
	9	0.286	1.188	0.834	0.575		0.977	0.981	0.841	0.703	0.864	0.805	0.246
	10	0.547	0.250	0.216	0.148		0.230	0.059	0.161	0.090	0.240	0.216	0.133
	11	0.156	0.211	0.061	0.039		0.023	0.012	0.023	0.024		0.069	0.069
	12		0.068	0.003						0.011	0.084	0.041	0.035
	13						0.011	0.007				0.009	0.002
	Total	9.867	9.620	9.367	9.569		10.685	10.352	9.989	8.690	9.788	9.770	0.540
A	6	0.952	0.935	0.919	1.000		0.858	0.927	0.908	1.103	1.004	0.956	0.067
	7	4.771	5.585	5.516	5.885		5.826	5.783	5.470	5.693	5.976	5.612	0.338
	8	5.292	7.211	7.350	7.387		8.487	7.020	7.114	7.032	7.885	7.198	0.809
	9	4.469	6.250	6.214	6.348		8.228	6.130	6.044	5.938	6.813	6.270	0.917
	10	2.226	3.620	4.711	3.901		5.666	4.031	4.808	2.712	4.402	4.009	1.003
	11	0.823	1.352	1.022	1.968		2.615	2.251	0.742	1.139	1.304	1.468	0.621
	12	0.696	1.263	0.774	0.898		1.363	1.084	0.778	0.716	0.457	0.892	0.275
	13		0.056		0.033		0.129	0.085				0.076	0.036
	14				0.003		0.011					0.007	0.004
	15												
	Total	19.229	26.272	26.506	27.422		33.183	27.311	25.865	24.332	27.839	26.440	3.431
X	2	11.283	11.105	11.013	11.040		11.273	10.664	10.441	10.768		10.948	0.280
	3												
	4												
	5								0.076			0.076	0.000
	6		0.036		0.000							0.018	0.018
	Total	11.283	11.141	11.013	11.040		11.273	10.664	10.517	10.768		10.962	0.266
U*	0	0.039	0.435	3.122	0.348		0.136	1.210	1.830	4.984	7.660	2.196	2.472
	15+							0.174				0.174	0.000
	Total	0.039	0.435	3.122	0.348		0.136	1.384	1.830	4.984	7.660	2.216	2.465
Grand Total		99.996	99.993	99.999	100.000		100.009	100.000	100.000	100.000	99.999		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-8

DHA Weight % Results of Fuel 7 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.000							0.000	0.000
	2				0.000							0.000	0.000
	3	0.002	0.001	0.001	0.001		0.001	0.002				0.001	0.000
	4	0.751	0.472	0.365	0.475	0.679	0.385	0.436	0.408	0.429	0.478	0.488	0.120
	5	3.618	2.753	2.481	2.848	3.834	2.471	2.679	2.659	2.592	2.858	2.879	0.444
	6	2.043	1.882	1.800	1.964	2.596	1.785	1.794	1.859	1.758	1.980	1.946	0.235
	7	0.593	1.164	1.160	1.227	1.629	1.188	1.167	1.160	1.149	1.250	1.169	0.235
	8	0.681	0.793	0.763	0.792	1.032	0.766	0.770	0.727	0.753	0.806	0.788	0.088
	9	0.396	0.461	0.439	0.446	0.567	0.502	0.441	0.432	0.469	0.488	0.464	0.044
	10	0.256	0.334	0.303	0.272	0.002	0.352	0.289	0.339	0.291	0.357	0.279	0.098
	11	0.205	0.274	0.277	0.238	0.022	0.305	0.252	0.282	0.262	0.299	0.242	0.078
	12	0.115	0.149	0.171	0.177		0.208	0.169	0.153	0.160	0.216	0.169	0.029
	13	0.082	0.060	0.064	0.061	0.000	0.086	0.067	0.061	0.080	0.068	0.063	0.023
	14	0.003	0.014				0.016	0.015		0.023	0.014	0.014	0.006
	15	0.005	0.012		0.012		0.011	0.012				0.011	0.003
	16		0.011		0.002		0.011					0.008	0.004
	17		0.011									0.011	0.000
	18		0.009									0.009	0.000
	Total	8.750	8.400	7.824	8.516	10.360	8.087	8.094	8.081	7.964	8.812	8.489	0.699
I	4	0.082	0.051	0.035	0.048	0.071	0.042	0.045	0.043	0.045	0.049	0.051	0.014
	5	8.372	6.041	5.248	6.192	8.373	5.557	5.777	5.757	5.608	6.168	6.309	1.067
	6	7.315	5.947	5.630	6.208	8.209	5.808	5.799	5.761	5.934	6.099	6.271	0.788
	7	5.329	5.010	4.914	5.325	6.665	5.116	5.052	5.194	5.054	5.333	5.299	0.476
	8	14.111	17.287	17.209	17.596	17.231	19.284	16.978	17.108	17.437	18.407	17.265	1.248
	9	3.803	4.014	4.574	4.648	0.492	3.731	3.727	4.575	4.838	4.541	3.894	1.202
	10	1.529	1.885	2.130	1.616	0.457	1.765	1.931	2.451	1.822	1.730	1.732	0.493
	11	1.293	1.778	1.156	1.533		2.314	1.351	1.427	1.032	1.094	1.442	0.378
	12	0.322	0.841	0.598	0.422		0.409	0.349	0.524	0.381	0.156	0.445	0.183
	13	0.252	0.077	0.035	0.054		0.154	0.063	0.016		0.026	0.085	0.075
	14		0.132									0.132	0.000
	15		0.019									0.019	0.000
	16												
	17												
	18		0.005									0.005	0.000
	Total	42.408	43.087	41.529	43.642	41.497	44.180	41.071	42.855	42.151	43.602	42.602	0.991

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3												
	4	0.072	0.086	0.069	0.081		0.064	0.083	0.081	0.083	0.088	0.079	0.008
	5	3.077	2.383	2.257	2.279	3.147	2.026	2.286	2.238	2.559	2.675	2.493	0.353
	6	2.535	2.746	2.218	2.294	2.740	2.137	2.402	2.345	2.064	2.976	2.446	0.282
	7	1.122	1.561	1.933	1.367	0.188	1.094	1.105	1.969	1.896	2.179	1.441	0.565
	8	2.921	0.682	0.221	1.073	0.292	0.336	0.463	1.039	0.069	0.029	0.713	0.814
	9	0.411	0.389	0.325	0.508		0.406	0.259	0.278	0.240	0.508	0.369	0.095
	10	0.030	0.006	0.096	0.188	0.001	0.444	0.172	0.143	0.075	0.115	0.127	0.123
	11		0.047	0.059		0.000		0.061	0.053		0.074	0.049	0.023
	12		0.069	0.033	0.035		0.040		0.037		0.038	0.042	0.012
	13			0.007					0.021		0.027	0.018	0.008
	Total	10.168	7.969	7.218	7.825	6.368	6.547	6.831	8.202	6.985	8.709	7.682	1.098
N	5	0.465	0.310	0.294	0.419	0.550	0.362	0.401	0.307	0.296	0.330	0.373	0.081
	6	2.839	2.085	2.006	2.694	3.423	2.500	2.614	2.122	2.026	2.192	2.450	0.433
	7	4.719	3.151	3.204	3.547	3.613	3.424	4.046	3.397	3.079	2.877	3.506	0.509
	8	2.750	3.163	2.936	2.684	3.014	3.175	3.142	3.267	2.481	2.924	2.954	0.238
	9	1.031	1.893	1.778	1.467	0.000	1.379	1.790	1.833	1.749	2.093	1.501	0.577
	10	0.902	0.580	0.421	0.368		0.307	0.145	0.361	0.204	0.827	0.457	0.248
	11	0.278	0.178	0.089	0.065		0.118	0.035	0.122	0.181	0.085	0.128	0.070
	12	0.020	0.062	0.016			0.008				0.096	0.040	0.033
	13				0.002			0.018				0.010	0.008
	Total	13.004	11.422	10.744	11.245	10.600	11.273	12.190	11.411	10.016	11.423	11.333	0.786
A	6	0.618	0.525	0.515	0.569	0.739	0.473	0.524	0.515	0.528	0.559	0.557	0.071
	7	2.543	2.571	2.525	2.374	3.522	1.872	2.760	2.563	2.450	2.682	2.586	0.387
	8	3.989	4.564	4.499	4.632	6.083	4.791	4.281	4.284	4.205	4.721	4.605	0.547
	9	3.809	4.376	4.169	4.379	6.043	5.169	4.494	3.738	4.378	4.631	4.519	0.637
	10	2.031	3.184	4.186	3.031	2.041	3.863	3.631	4.032	3.056	4.517	3.357	0.809
	11	0.640	1.248	0.713	1.503	0.701	1.867	2.023	0.723	1.078	1.080	1.158	0.475
	12	0.658	0.936	0.778	0.618	0.398	0.748	0.783	0.801	0.753	0.438	0.691	0.158
	13		0.014		0.003		0.004	0.099				0.030	0.040
	14		0.006		0.002							0.004	0.002
	15												
	Total	14.288	17.424	17.385	17.112	19.527	18.787	18.595	16.655	16.447	18.628	17.485	1.433
X	2	11.057	10.874	10.632	10.620	11.647	10.865	10.352	9.860	10.295		10.689	0.481
	3				0.000							0.000	0.000
	4				0.000				0.278			0.139	0.139
	5								0.120			0.120	0.000
	6		0.056									0.056	0.000
	Total	11.057	10.930	10.632	10.620	11.647	10.865	10.352	10.258	10.295		10.740	0.419
U*	0	0.318	0.747	4.665	1.039		0.265	2.651	2.540	6.142	8.825	3.021	2.799
	15+							0.216				0.216	0.000
	Total	0.318	0.747	4.665	1.039	0.000	0.265	2.868	2.540	6.142	8.825	2.741	2.806
Grand Total		99.993	99.979	99.997	100.000	100.000	100.004	100.000	100.001	100.000	99.999		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix III-9

DHA Weight % Results of Fuel 8 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1												
	2								0.014			0.014	0.000
	3	0.014	0.013	0.008	0.012		0.008	0.015		0.010		0.011	0.003
	4	5.531	5.432	4.420	5.446	7.244	4.069	5.438	5.444	4.489	5.560	5.307	0.832
	5	4.430	4.324	3.925	4.412	5.479	3.741	4.270	4.306	3.994	4.575	4.346	0.450
	6	2.276	2.261	2.171	2.334	2.852	2.137	2.173	2.229	2.144	2.433	2.301	0.204
	7	0.696	1.328	1.334	1.388	1.790	1.361	1.315	1.295	1.328	1.451	1.329	0.252
	8	0.715	0.782	0.726	0.726	0.804	0.738	0.668	0.672	0.709	0.769	0.731	0.042
	9	0.439	0.404	0.413	0.393	0.503	0.487	0.396	0.388	0.428	0.451	0.430	0.038
	10	0.213	0.198	0.199	0.176	0.000	0.224	0.181	0.208	0.193	0.205	0.180	0.061
	11	0.120	0.108	0.125	0.115	0.003	0.157	0.102	0.163	0.112	0.138	0.114	0.042
	12	0.053	0.049	0.064	0.096		0.074	0.069	0.018	0.067	0.119	0.068	0.027
	13	0.051	0.036	0.036	0.042	0.001	0.047	0.046		0.223	0.034	0.057	0.060
	14	0.016	0.021				0.044	0.017		0.060	0.015	0.029	0.017
	15		0.010		0.002		0.010	0.009				0.008	0.003
	16		0.007				0.008					0.008	0.001
	17		0.007				0.004					0.006	0.002
	18		0.006				0.007					0.007	0.001
	Total	14.554	14.986	13.421	15.143	18.676	13.116	14.698	14.737	13.756	15.750	14.884	1.480
I	4	0.359	0.275	0.215	0.273	0.374	0.211	0.280	0.287	0.222	0.279	0.278	0.052
	5	8.984	8.728	7.699	8.838	11.017	7.620	8.571	8.722	7.885	9.114	8.718	0.921
	6	8.108	7.602	7.212	7.850	9.595	7.318	7.502	3.571	7.491	6.815	7.306	1.433
	7	5.316	5.057	5.018	5.255	5.881	5.094	5.030	5.183	5.122	5.380	5.234	0.245
	8	3.890	3.817	3.990	3.404	3.952	4.004	3.832	3.151	4.271	4.187	3.850	0.322
	9	2.283	2.354	2.468	2.190	0.278	2.139	2.062	2.237	2.933	2.522	2.146	0.666
	10	0.855	1.353	1.432	0.930	0.001	1.071	1.240	1.661	1.673	1.104	1.132	0.461
	11	0.491	0.704	0.591	0.417		0.570	0.407	0.478	0.640	0.331	0.514	0.114
	12	0.150	0.491	0.592	0.249		0.215	0.102	0.652	0.407	0.160	0.335	0.193
	13	0.201	0.058	0.024	0.052		0.189	0.047	0.106		0.038	0.089	0.065
	14		0.238									0.238	0.000
	15		0.019									0.019	0.000
	16		0.004									0.004	0.000
	17		0.008									0.008	0.000
	18		0.003									0.003	0.000
	Total	30.637	30.711	29.241	29.457	31.097	28.431	29.072	26.047	30.644	29.931	29.527	1.418

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.000	0.000							0.000	0.000
	4	0.064	0.092	0.077	0.087		0.064	0.097	0.081	0.085	0.038	0.076	0.017
	5	2.681	2.556	2.458	2.378	3.027	2.088	2.447	2.195	2.765	9.070	3.166	1.985
	6	1.772	2.064	1.742	1.700	1.659	1.612	1.809	5.367	1.380	2.253	2.136	1.101
	7	0.890	1.235	1.451	1.041	0.001	1.092	0.945	1.528	1.514	1.577	1.127	0.447
	8	0.172	0.490	0.159	0.807	0.001	0.280	0.372	1.064	0.073		0.380	0.334
	9	0.139	0.431	0.226	0.139		0.201	0.188	0.197	0.095	0.224	0.205	0.090
	10	0.042		0.042	0.088	0.000	0.309	0.106	0.030	0.049	0.040	0.078	0.087
	11		0.025	0.024		0.001		0.021	0.034			0.021	0.011
	12		0.050	0.015	0.006		0.010		0.022		0.017	0.020	0.014
	13			0.013					0.040		0.047	0.033	0.014
	Total	5.760	6.943	6.207	6.247	4.689	5.656	5.985	10.556	5.959	13.267	7.127	2.525
N	5	0.529	0.393	0.376	0.549	0.672	0.471	0.526	0.397	0.384	0.427	0.472	0.091
	6	2.528	2.161	2.078	2.588	3.037	2.396	2.495	2.191	2.102	2.309	2.389	0.277
	7	3.929	2.419	2.688	2.865	2.647	2.972	3.120	2.744	2.433	2.624	2.844	0.417
	8	2.291	1.709	2.127	1.792	0.002	2.356	2.262	2.430	1.965	2.360	1.929	0.684
	9	0.965	1.081	1.114	0.797	0.000	1.063	1.200	1.139	0.873	0.875	0.911	0.328
	10	1.138	0.312	0.299	0.260		0.273	0.077	0.273	0.113	0.395	0.349	0.294
	11	0.459	0.197	0.052	0.053		0.003	0.018	0.056	0.014		0.107	0.145
	12	0.004	0.064	0.006					0.061	0.014	0.066	0.036	0.028
	13				0.004		0.011	0.008				0.008	0.003
	Total	11.843	8.336	8.740	8.907	6.357	9.545	9.707	9.291	7.898	9.056	8.968	1.329
A	6	1.697	1.604	1.560	1.704	2.017	1.454	1.602	1.538	1.784	1.720	1.668	0.149
	7	5.469	5.226	5.190	5.475	6.630	5.190	5.238	4.969	5.189	5.550	5.413	0.438
	8	7.464	7.300	7.441	7.402	9.154	7.898	7.013	6.849	7.126	7.808	7.546	0.618
	9	6.538	6.138	6.041	6.168	7.775	7.360	5.895	5.607	5.811	6.570	6.390	0.659
	10	3.596	3.622	4.867	4.092	2.380	4.866	4.071	4.241	2.897	4.789	3.942	0.794
	11	1.269	1.488	1.095	2.062	0.759	2.790	2.457	0.499	1.171	1.792	1.538	0.696
	12	1.582	1.172	0.850	0.941	0.003	1.228	1.034	0.794	0.844	0.538	0.898	0.402
	13		0.030		0.032		0.071	0.113				0.062	0.034
	14		0.003		0.001		0.008					0.004	0.003
	15												
	Total	27.615	26.583	27.044	27.877	28.718	30.865	27.424	24.496	24.822	28.767	27.421	1.782
X	2	9.461	11.881	11.743	11.680	10.463	12.223	11.280	10.861	11.455		11.227	0.802
	3												
	4												
	5								0.100			0.100	0.000
	6		0.044									0.044	0.000
	Total	9.461	11.925	11.743	11.680	10.463	12.223	11.280	10.962	11.455		11.244	0.801
U*	0	0.139	0.503	3.604	0.688		0.161	1.607	3.912	5.465	3.229	2.145	1.841
	15+							0.227				0.227	0.000
	Total	0.139	0.503	3.604	0.688	0.000	0.161	1.834	3.912	5.465	3.229	1.953	1.859
Grand Total		100.009	99.987	100.000	100.000	100.000	99.997	100.000	100.000	100.001	100.000		

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-1

DHA PMI Results of Fuel 1 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.0000							0.0000	0.0000
	3	0.0000		0.0000	0.0000						0.0000	0.0000	0.0000
	4	0.0004	0.0005	0.0005	0.0005	0.0007	0.0005	0.0004	0.0005	0.0005	0.0006	0.0005	0.0001
	5	0.0005	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005	0.0005	0.0005	0.0031	0.0008	0.0008
	6	0.0007	0.0008	0.0008	0.0008	0.0010	0.0008	0.0007	0.0008	0.0007	0.0038	0.0011	0.0009
	7	0.0014	0.0027	0.0026	0.0027	0.0034	0.0026	0.0026	0.0026	0.0026	0.0025	0.0026	0.0005
	8	0.0025	0.0025	0.0023	0.0023	0.0028	0.0022	0.0023	0.0025	0.0023	0.0022	0.0024	0.0002
	9	0.0017	0.0015	0.0015	0.0014	0.0018	0.0015	0.0014	0.0015	0.0015	0.0017	0.0015	0.0001
	10	0.0010	0.0010	0.0008	0.0008	0.0000	0.0009	0.0009	0.0008	0.0009	0.0013	0.0008	0.0003
	11	0.0008	0.0007	0.0007	0.0006	0.0000	0.0007	0.0006	0.0012	0.0006	0.0014	0.0007	0.0004
	12	0.0009	0.0002	0.0003	0.0006		0.0008	0.0002	0.0005	0.0003	0.0030	0.0008	0.0008
	13	0.0002	0.0001	0.0001	0.0000	0.0000	0.0029	0.0002	0.0023	0.0027	0.0137	0.0022	0.0040
	14	0.0013	0.0003				0.0004	0.0003		0.0017	0.0011	0.0008	0.0005
	15				0.0001		0.0007	0.0008				0.0005	0.0003
	16				0.0003							0.0003	0.0000
	Total	0.0113	0.0107	0.0100	0.0106	0.0104	0.0146	0.0110	0.0133	0.0144	0.0342	0.0141	0.0069
I	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0020	0.0021	0.0021	0.0022	0.0028	0.0022	0.0021	0.0022	0.0021	0.0035	0.0023	0.0005
	6	0.0052	0.0052	0.0051	0.0053	0.0066	0.0052	0.0051	0.0054	0.0053	0.0060	0.0054	0.0005
	7	0.0131	0.0128	0.0124	0.0126	0.0150	0.0124	0.0126	0.0130	0.0126	0.0080	0.0124	0.0017
	8	0.0537	0.0495	0.0487	0.0404	0.0404	0.0539	0.0455	0.0479	0.0489	0.0122	0.0441	0.0115
	9	0.0157	0.0124	0.0143	0.0165	0.0013	0.0116	0.0135	0.0149	0.0136	0.0097	0.0124	0.0041
	10	0.0137	0.0107	0.0115	0.0061	0.0000	0.0082	0.0104	0.0116	0.0076	0.0068	0.0087	0.0037
	11	0.0140	0.0153	0.0059	0.0176		0.0198	0.0116	0.0085	0.0068	0.0105	0.0122	0.0045
	12	0.0048	0.0046	0.0028	0.0028		0.0030	0.0025	0.0026	0.0038	0.0052	0.0036	0.0010
	13	0.0053	0.0002	0.0001	0.0014		0.0027	0.0011			0.0011	0.0017	0.0017
	14		0.0017									0.0017	0.0000
	15		0.0010									0.0010	0.0000
	17		0.0005									0.0005	0.0000
	Total	0.1274	0.1160	0.1030	0.1049	0.0661	0.1190	0.1045	0.1061	0.1007	0.0630	0.1011	0.0199

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.0000							0.0000	0.0000
	3				0.0000		0.0000					0.0000	0.0000
	4	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0001	0.0000	0.0000
	5	0.0025	0.0029	0.0030	0.0026	0.0034	0.0027	0.0027	0.0034	0.0032	0.0021	0.0028	0.0004
	6	0.0032	0.0047	0.0040	0.0033	0.0033	0.0033	0.0036	0.0041	0.0037	0.0034	0.0037	0.0004
	7	0.0022	0.0038	0.0034	0.0123	0.0000	0.0023	0.0021	0.0036	0.0037	0.0051	0.0038	0.0031
	8	0.0001	0.0015	0.0005	0.0020	0.0000	0.0008	0.0011	0.0045	0.0002	0.0006	0.0011	0.0013
	9	0.0000	0.0017	0.0007	0.0016		0.0014	0.0005	0.0003	0.0019	0.0019	0.0011	0.0007
	10	0.0001	0.0001	0.0015	0.0008	0.0000	0.0016	0.0013		0.0001	0.0009	0.0007	0.0006
	11		0.0007	0.0009		0.0000	0.0009	0.0013	0.0007		0.0006	0.0007	0.0004
	12		0.0003	0.0001	0.0001				0.0011		0.0007	0.0005	0.0004
	13			0.0011							0.0041	0.0026	0.0015
	Total	0.0081	0.0156	0.0150	0.0227	0.0067	0.0130	0.0127	0.0177	0.0127	0.0193	0.0143	0.0046
N	5	0.0004	0.0003	0.0003	0.0005	0.0007	0.0005	0.0005	0.0003	0.0002	0.0007	0.0004	0.0002
	6	0.0057	0.0048	0.0047	0.0060	0.0070	0.0061	0.0061	0.0050	0.0047	0.0081	0.0058	0.0011
	7	0.0117	0.0059	0.0061	0.0067	0.0067	0.0057	0.0088	0.0066	0.0059	0.0082	0.0072	0.0018
	8	0.0063	0.0070	0.0063	0.0056	0.0089	0.0062	0.0061	0.0067	0.0057	0.0112	0.0070	0.0016
	9	0.0026	0.0097	0.0062	0.0044	0.0000	0.0019	0.0048	0.0029	0.0107	0.0115	0.0055	0.0038
	10	0.0244	0.0060	0.0028	0.0013		0.0007	0.0006	0.0007	0.0024	0.0068	0.0051	0.0072
	11	0.0123	0.0047	0.0004	0.0004		0.0002	0.0004	0.0043	0.0044	0.0007	0.0031	0.0038
	12		0.0011	0.0001					0.0010		0.0043	0.0016	0.0016
	13				0.0003			0.0024				0.0013	0.0011
	Total	0.0635	0.0393	0.0268	0.0252	0.0233	0.0213	0.0297	0.0274	0.0342	0.0514	0.0342	0.0129
A	6	0.0041	0.0041	0.0041	0.0043	0.0053	0.0041	0.0042	0.0041	0.0044	0.0060	0.0045	0.0006
	7	0.0775	0.0724	0.0695	0.0615	0.0883	0.0579	0.0859	0.0692	0.0703	0.0722	0.0725	0.0090
	8	0.1744	0.1635	0.1477	0.1580	0.1740	0.1634	0.1577	0.1418	0.1414	0.1737	0.1596	0.0120
	9	0.2309	0.1867	0.1857	0.1940	0.2459	0.2109	0.2091	0.1763	0.2040	0.3053	0.2149	0.0362
	10	0.2588	0.2240	0.2494	0.2021	0.0784	0.2274	0.2183	0.1716	0.1508	0.4810	0.2262	0.0988
	11	0.0648	0.1352	0.1024	0.1366	0.0000	0.1147	0.1655	0.0669	0.0658	0.3600	0.1212	0.0915
	12	0.1035	0.1078	0.0313	0.0748	0.0002	0.1334	0.1204	0.0454	0.1114	0.0833	0.0812	0.0409
	13		0.0171		0.0067			0.0176				0.0138	0.0050
	14				0.0031		0.0020					0.0026	0.0006
	Total	0.9140	0.9108	0.7900	0.8411	0.5921	0.9139	0.9787	0.6755	0.7481	1.4816	0.8846	0.2294
X	2	0.0092	0.0123	0.0132	0.0132	0.0130	0.0122	0.0129	0.0126	0.0128		0.0124	0.0012
	3				0.0000							0.0000	0.0000
	4				0.0000							0.0000	0.0000
	5								0.0001			0.0001	0.0000
	6		0.0001		0.0000							0.0000	0.0000
	Total	0.0092	0.0124	0.0132	0.0132	0.0130	0.0122	0.0129	0.0127	0.0128		0.0124	0.0012
U*	0	0.0002	0.0017	0.2000	0.1398		0.0183	0.0475	0.0360	0.1012	0.4292	0.1082	0.1302
	15+							0.0730				0.0730	0.0000
	Total	0.0002	0.0017	0.2000	0.1398	0.0000	0.0183	0.1205	0.0360	0.1012	0.4292	0.1047	0.1267
Grand Total		1.1337	1.1065	1.1581	1.1573	0.7115	1.1122	1.2701	0.8886	1.0241	2.0787	1.1641	0.3398

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-2

DHA PMI Results of Fuel 2 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.0000							0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000				0.0000	0.0000
	4	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000
	5	0.0023	0.0019	0.0018	0.0020	0.0024	0.0019	0.0019	0.0019	0.0019	0.0020	0.0020	0.0002
	6	0.0024	0.0023	0.0023	0.0024	0.0030	0.0024	0.0023	0.0024	0.0023	0.0025	0.0024	0.0002
	7	0.0033	0.0033	0.0033	0.0034	0.0045	0.0035	0.0033	0.0033	0.0033	0.0036	0.0035	0.0004
	8	0.0037	0.0039	0.0039	0.0040	0.0049	0.0039	0.0039	0.0045	0.0038	0.0042	0.0041	0.0003
	9	0.0033	0.0036	0.0035	0.0034	0.0043	0.0037	0.0034	0.0034	0.0037	0.0038	0.0036	0.0003
	10	0.0024	0.0029	0.0026	0.0025	0.0000	0.0028	0.0025	0.0028	0.0025	0.0008	0.0022	0.0009
	11	0.0022	0.0026	0.0025	0.0022	0.0001	0.0024	0.0022	0.0029	0.0022	0.0031	0.0022	0.0008
	12	0.0000	0.0022	0.0025	0.0030		0.0027	0.0024	0.0024	0.0023	0.0038	0.0024	0.0010
	13	0.0013	0.0014	0.0018	0.0014	0.0000	0.0018	0.0019		0.0046	0.0016	0.0017	0.0011
	14	0.0009	0.0009				0.0015	0.0009		0.0022		0.0013	0.0005
	15		0.0008		0.0001			0.0012				0.0007	0.0004
	16		0.0011									0.0011	0.0000
	17		0.0034									0.0034	0.0000
	18		0.0049				0.0027					0.0038	0.0011
	Total	0.0222	0.0353	0.0245	0.0247	0.0194	0.0295	0.0261	0.0239	0.0290	0.0256	0.0260	0.0042
I	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0037	0.0028	0.0027	0.0030	0.0036	0.0028	0.0028	0.0028	0.0029	0.0030	0.0030	0.0003
	6	0.0054	0.0047	0.0046	0.0049	0.0060	0.0048	0.0047	0.0048	0.0048	0.0043	0.0049	0.0005
	7	0.0078	0.0075	0.0075	0.0079	0.0095	0.0078	0.0077	0.0079	0.0077	0.0082	0.0079	0.0005
	8	0.0159	0.0182	0.0183	0.0168	0.0166	0.0187	0.0167	0.0160	0.0175	0.0181	0.0173	0.0010
	9	0.0117	0.0127	0.0131	0.0118	0.0013	0.0102	0.0110	0.0135	0.0140	0.0138	0.0113	0.0036
	10	0.0093	0.0141	0.0132	0.0092	0.0000	0.0096	0.0100	0.0145	0.0148	0.0109	0.0106	0.0041
	11	0.0087	0.0125	0.0083	0.0087		0.0097	0.0075	0.0115	0.0090	0.0215	0.0108	0.0041
	12	0.0036	0.0097	0.0095	0.0170		0.0039	0.0029	0.0086	0.0052	0.0025	0.0070	0.0044
	13	0.0091	0.0015	0.0007	0.0007		0.0054	0.0013	0.0019		0.0005	0.0026	0.0029
	14		0.0044									0.0044	0.0000
	15		0.0002									0.0002	0.0000
	Total	0.0753	0.0883	0.0777	0.0799	0.0370	0.0729	0.0645	0.0814	0.0758	0.0826	0.0736	0.0136

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.0000	0.0000							0.0000	0.0000
	4	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0000
	5	0.0034	0.0029	0.0029	0.0028	0.0035	0.0028	0.0028	0.0030	0.0032	0.0067	0.0034	0.0011
	6	0.0036	0.0051	0.0042	0.0034	0.0039	0.0035	0.0036	0.0044	0.0040	0.0064	0.0042	0.0009
	7	0.0029	0.0052	0.0052	0.0034	0.0004	0.0032	0.0030	0.0052	0.0052	0.0071	0.0041	0.0018
	8	0.0033	0.0033	0.0010	0.0054	0.0000	0.0028	0.0023	0.0066	0.0004	0.0003	0.0025	0.0021
	9	0.0026	0.0025	0.0024	0.0022		0.0012	0.0021	0.0023	0.0011	0.0068	0.0026	0.0016
	10	0.0004	0.0015	0.0008	0.0019	0.0000	0.0036	0.0019	0.0013	0.0007	0.0012	0.0013	0.0010
	11		0.0007	0.0008	0.0005	0.0027		0.0008	0.0008		0.0166	0.0033	0.0055
	12		0.0022	0.0003	0.0005				0.0031		0.0009	0.0014	0.0011
	13			0.0009					0.0031			0.0020	0.0011
	Total	0.0163	0.0234	0.0184	0.0201	0.0105	0.0172	0.0168	0.0300	0.0146	0.0460	0.0213	0.0096
N	5	0.0007	0.0005	0.0005	0.0007	0.0008	0.0007	0.0007	0.0005	0.0005	0.0005	0.0006	0.0001
	6	0.0064	0.0048	0.0046	0.0064	0.0075	0.0063	0.0063	0.0049	0.0047	0.0051	0.0057	0.0010
	7	0.0139	0.0102	0.0104	0.0121	0.0116	0.0131	0.0140	0.0109	0.0100	0.0101	0.0116	0.0015
	8	0.0153	0.0165	0.0150	0.0154	0.0024	0.0180	0.0163	0.0150	0.0140	0.0112	0.0139	0.0042
	9	0.0088	0.0161	0.0138	0.0108	0.0096	0.0121	0.0150	0.0146	0.0124	0.0156	0.0129	0.0024
	10	0.0459	0.0079	0.0054	0.0069		0.0205	0.0023	0.0047	0.0049	0.0081	0.0118	0.0130
	11	0.0192	0.0090	0.0023	0.0021		0.0027	0.0009	0.0022	0.0016	0.0027	0.0047	0.0056
	12			0.0003						0.0006	0.0165	0.0058	0.0076
	13							0.0018				0.0018	0.0000
	Total	0.1102	0.0650	0.0521	0.0543	0.0321	0.0734	0.0573	0.0527	0.0486	0.0698	0.0616	0.0197
A	6	0.0037	0.0034	0.0034	0.0037	0.0044	0.0035	0.0035	0.0034	0.0036	0.0038	0.0037	0.0003
	7	0.0740	0.0744	0.0720	0.0759	0.0933	0.0741	0.0804	0.0718	0.0772	0.0777	0.0771	0.0060
	8	0.1370	0.1499	0.1383	0.1487	0.1858	0.1542	0.1423	0.1343	0.1283	0.1485	0.1467	0.0151
	9	0.3529	0.3655	0.3367	0.3640	0.4410	0.3982	0.3640	0.3272	0.3354	0.3671	0.3652	0.0318
	10	0.3471	0.3970	0.4843	0.3932	0.2282	0.4917	0.4409	0.3929	0.2310	0.2428	0.3649	0.0952
	11	0.1609	0.2717	0.1864	0.2770	0.0901	0.2941	0.3208	0.1815	0.1406	0.2095	0.2133	0.0711
	12	0.1271	0.2073	0.0959	0.1209	0.0244	0.1424	0.1887	0.1087	0.1156	0.1312	0.1262	0.0474
	13		0.0154		0.0022		0.0359	0.0220				0.0189	0.0121
	14				0.0642							0.0642	0.0000
	Total	1.2028	1.4847	1.3170	1.4499	1.0671	1.5941	1.5626	1.2198	1.0316	1.1806	1.3110	0.1917
X	2	0.0113	0.0119	0.0124	0.0125	0.0112	0.0118	0.0122	0.0116	0.0122		0.0119	0.0004
	3												
	4												
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0113	0.0119	0.0124	0.0125	0.0112	0.0118	0.0122	0.0117	0.0122		0.0119	0.0004
U*	0	0.0078	0.0073	0.2648	0.1075	0.0037	0.0380	0.1093	0.1352	0.2970	0.1253	0.1096	0.0986
	15+							0.0814				0.0814	0.0000
	Total	0.0078	0.0073	0.2648	0.1075	0.0037	0.0380	0.1906	0.1352	0.2970	0.1253	0.1177	0.1016
Grand Total		1.4459	1.7159	1.7670	1.7491	1.1810	1.8369	1.9301	1.5548	1.5088	1.5299	1.6219	0.2094

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-3

DHA PMI Results of Fuel 3 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.0000							0.0000	0.0000
	3	0.0000		0.0000	0.0000						0.0000	0.0000	0.0000
	4	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000
	5	0.0015	0.0012	0.0011	0.0012	0.0016	0.0013	0.0012	0.0012	0.0011	0.0013	0.0013	0.0001
	6	0.0025	0.0023	0.0023	0.0024	0.0030	0.0024	0.0023	0.0022	0.0022	0.0026	0.0024	0.0002
	7	0.0014	0.0027	0.0027	0.0029	0.0037	0.0028	0.0027	0.0026	0.0027	0.0031	0.0027	0.0005
	8	0.0023	0.0025	0.0025	0.0025	0.0031	0.0024	0.0025	0.0023	0.0025	0.0028	0.0025	0.0002
	9	0.0022	0.0023	0.0022	0.0022	0.0027	0.0023	0.0022	0.0020	0.0024	0.0025	0.0023	0.0002
	10	0.0019	0.0022	0.0020	0.0019	0.0000	0.0021	0.0019	0.0033	0.0020	0.0007	0.0018	0.0008
	11	0.0019	0.0023	0.0022	0.0021	0.0001	0.0022	0.0019	0.0035	0.0020	0.0026	0.0021	0.0008
	12	0.0016	0.0024	0.0022	0.0037		0.0022	0.0025	0.0020	0.0024	0.0045	0.0026	0.0008
	13	0.0031	0.0035	0.0026	0.0024	0.0001	0.0031	0.0033		0.0151	0.0138	0.0052	0.0050
	14	0.0010	0.0020				0.0040	0.0018		0.0067	0.0016	0.0028	0.0020
	15		0.0005		0.0000		0.0005	0.0007				0.0004	0.0002
	16				0.0005							0.0005	0.0000
	17												
	18												
	Total	0.0196	0.0239	0.0199	0.0219	0.0143	0.0253	0.0229	0.0192	0.0393	0.0355	0.0242	0.0073
I	4	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0037	0.0029	0.0026	0.0028	0.0036	0.0029	0.0029	0.0028	0.0025	0.0031	0.0030	0.0004
	6	0.0072	0.0061	0.0059	0.0063	0.0079	0.0064	0.0062	0.0030	0.0060	0.0066	0.0062	0.0012
	7	0.0098	0.0093	0.0092	0.0097	0.0118	0.0095	0.0094	0.0092	0.0094	0.0103	0.0098	0.0007
	8	0.0111	0.0115	0.0120	0.0106	0.0117	0.0118	0.0117	0.0091	0.0127	0.0130	0.0115	0.0010
	9	0.0101	0.0118	0.0121	0.0110	0.0016	0.0094	0.0107	0.0107	0.0143	0.0130	0.0104	0.0033
	10	0.0065	0.0118	0.0124	0.0093	0.0000	0.0079	0.0111	0.0251	0.0152	0.0104	0.0110	0.0061
	11	0.0064	0.0120	0.0081	0.0065		0.0067	0.0070	0.0185	0.0091	0.0052	0.0088	0.0039
	12	0.0030	0.0140	0.0150	0.0060		0.0036	0.0021	0.0117	0.0102	0.0050	0.0078	0.0047
	13	0.0053	0.0038	0.0015	0.0023		0.0084	0.0030	0.0059		0.0016	0.0040	0.0023
	14		0.0130									0.0130	0.0000
	15		0.0014									0.0014	0.0000
	16												
	17		0.0006									0.0006	0.0000
	Total	0.0632	0.0982	0.0789	0.0647	0.0365	0.0668	0.0639	0.0959	0.0794	0.0681	0.0715	0.0169

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.0000							0.0000	0.0000
	3			0.0000	0.0000							0.0000	0.0000
	4	0.0001	0.0000	0.0000	0.0000		0.0000	0.0000	0.0003	0.0000	0.0000	0.0001	0.0001
	5	0.0030	0.0026	0.0026	0.0023	0.0030	0.0025	0.0024	0.0031	0.0027	0.0025	0.0027	0.0002
	6	0.0036	0.0045	0.0039	0.0032	0.0034	0.0033	0.0033	0.0089	0.0028	0.0049	0.0042	0.0017
	7	0.0029	0.0056	0.0048	0.0038	0.0000	0.0032	0.0033	0.0046	0.0054	0.0067	0.0040	0.0018
	8	0.0016	0.0025	0.0009	0.0059	0.0015	0.0017	0.0019	0.0063	0.0004	0.0008	0.0023	0.0020
	9	0.0012	0.0019	0.0021	0.0017		0.0019	0.0017	0.0018	0.0009	0.0023	0.0017	0.0004
	10		0.0006	0.0004	0.0021	0.0000	0.0035	0.0020	0.0034	0.0007	0.0013	0.0016	0.0012
	11		0.0010	0.0009	0.0002	0.0000		0.0007	0.0022		0.0008	0.0008	0.0007
	12		0.0038	0.0004	0.0013		0.0012				0.0012	0.0016	0.0012
	13		0.0008	0.0009					0.0050		0.0060	0.0032	0.0024
	Total	0.0123	0.0234	0.0168	0.0205	0.0079	0.0173	0.0153	0.0355	0.0129	0.0266	0.0189	0.0076
N	4				0.0000							0.0000	0.0000
	5	0.0007	0.0004	0.0004	0.0006	0.0008	0.0007	0.0006	0.0004	0.0004	0.0004	0.0005	0.0002
	6	0.0063	0.0048	0.0047	0.0062	0.0073	0.0063	0.0061	0.0048	0.0047	0.0053	0.0056	0.0009
	7	0.0161	0.0094	0.0104	0.0112	0.0115	0.0128	0.0131	0.0102	0.0094	0.0104	0.0115	0.0020
	8	0.0158	0.0140	0.0143	0.0136	0.0018	0.0160	0.0164	0.0159	0.0138	0.0146	0.0136	0.0041
	9	0.0113	0.0136	0.0127	0.0103	0.0000	0.0108	0.0146	0.0134	0.0117	0.0150	0.0113	0.0041
	10	0.0604	0.0061	0.0067	0.0092		0.0050	0.0023	0.0168	0.0024	0.0173	0.0140	0.0172
	11	0.0200	0.0091	0.0017	0.0039		0.0003	0.0009	0.0068	0.0005		0.0054	0.0063
	12		0.0057	0.0003						0.0008	0.0052	0.0030	0.0025
	13				0.0010		0.0013	0.0015				0.0013	0.0002
	Total	0.1305	0.0631	0.0511	0.0560	0.0214	0.0531	0.0556	0.0682	0.0437	0.0682	0.0611	0.0265
A	6	0.0120	0.0110	0.0108	0.0118	0.0143	0.0113	0.0109	0.0103	0.0121	0.0120	0.0116	0.0011
	7	0.0739	0.0749	0.0739	0.0791	0.0963	0.0754	0.0764	0.0690	0.0748	0.0814	0.0775	0.0070
	8	0.1854	0.2021	0.1865	0.2072	0.2547	0.2027	0.1947	0.1680	0.1800	0.2039	0.1985	0.0221
	9	0.3155	0.3325	0.3085	0.3385	0.4243	0.3520	0.3209	0.3065	0.3163	0.3466	0.3361	0.0329
	10	0.6256	0.5135	0.5626	0.4819	0.2570	0.5690	0.5298	0.5029	0.2701	0.5322	0.4845	0.1168
	11	0.2651	0.5831	0.4362	0.6181	0.1257	0.7124	0.6589	0.3649	0.1680	0.4474	0.4380	0.1958
	12	0.4573	0.5879	0.1619	0.4149	0.0319	0.4186	0.4815	0.1392	0.1852	0.1134	0.2992	0.1824
	13		0.0286		0.0369		0.0570	0.0564				0.0447	0.0123
	14				0.0124							0.0124	0.0000
	15				0.0008							0.0008	0.0000
	Total	1.9347	2.3335	1.7404	2.2016	1.2042	2.3982	2.3294	1.5608	1.2067	1.7369	1.8646	0.4280
X	2	0.0112	0.0118	0.0120	0.0121	0.0112	0.0120	0.0119	0.0108	0.0115		0.0116	0.0004
	3				0.0000							0.0000	0.0000
	4				0.0000							0.0000	0.0000
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0112	0.0118	0.0120	0.0121	0.0112	0.0120	0.0119	0.0109	0.0115		0.0116	0.0004
U*	0	0.0014	0.0176	0.4719	0.1357		0.0210	0.1431	0.2860	0.6441	0.4528	0.2415	0.2209
	15+							0.0732				0.0732	0.0000
	Total	0.0014	0.0176	0.4719	0.1357	0.0000	0.0210	0.2163	0.2860	0.6441	0.4528	0.2247	0.2203
Grand Total		2.1729	2.5716	2.3910	2.5124	1.2956	2.5937	2.7154	2.0766	2.0375	2.3881	2.2755	0.3913

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-4

DHA PMI Results of Fuel 4 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1												
	3	0.0000		0.0000	0.0000		0.0000				0.0000	0.0000	0.0000
	4	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
	5	0.0016	0.0013	0.0013	0.0014	0.0017	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0001
	6	0.0028	0.0027	0.0026	0.0028	0.0033	0.0027	0.0026	0.0027	0.0026	0.0028	0.0028	0.0002
	7	0.0018	0.0035	0.0034	0.0036	0.0045	0.0035	0.0034	0.0035	0.0034	0.0037	0.0034	0.0006
	8	0.0036	0.0038	0.0037	0.0037	0.0044	0.0037	0.0037	0.0042	0.0036	0.0040	0.0039	0.0003
	9	0.0036	0.0037	0.0035	0.0036	0.0043	0.0036	0.0035	0.0035	0.0037	0.0038	0.0037	0.0002
	10	0.0026	0.0030	0.0026	0.0025	0.0000	0.0028	0.0026	0.0028	0.0026	0.0008	0.0022	0.0009
	11	0.0020	0.0023	0.0023	0.0021	0.0001	0.0024	0.0020	0.0019	0.0020	0.0025	0.0020	0.0006
	12	0.0023	0.0027	0.0027	0.0042		0.0028	0.0026	0.0025	0.0025	0.0048	0.0030	0.0008
	13	0.0029	0.0028	0.0028	0.0026	0.0000	0.0034	0.0030		0.0078	0.0027	0.0031	0.0019
	14	0.0012	0.0020				0.0033	0.0015		0.0056	0.0015	0.0025	0.0015
	15		0.0017		0.0014		0.0012	0.0014				0.0014	0.0002
	16		0.0022									0.0022	0.0000
	17		0.0034									0.0034	0.0000
	18		0.0048				0.0376					0.0212	0.0164
	Total	0.0244	0.0398	0.0250	0.0281	0.0185	0.0684	0.0278	0.0226	0.0352	0.0281	0.0318	0.0135
I	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0027	0.0022	0.0022	0.0024	0.0028	0.0023	0.0023	0.0024	0.0023	0.0024	0.0024	0.0002
	6	0.0062	0.0054	0.0054	0.0057	0.0069	0.0056	0.0054	0.0028	0.0056	0.0056	0.0055	0.0010
	7	0.0098	0.0093	0.0092	0.0096	0.0114	0.0093	0.0093	0.0097	0.0094	0.0096	0.0097	0.0006
	8	0.0125	0.0126	0.0129	0.0114	0.0123	0.0130	0.0127	0.0100	0.0135	0.0139	0.0125	0.0010
	9	0.0110	0.0116	0.0119	0.0113	0.0000	0.0096	0.0110	0.0124	0.0135	0.0121	0.0104	0.0036
	10	0.0070	0.0122	0.0123	0.0086	0.0000	0.0083	0.0117	0.0139	0.0153	0.0106	0.0100	0.0041
	11	0.0064	0.0101	0.0064	0.0059		0.0070	0.0056	0.0115	0.0075	0.0126	0.0081	0.0025
	12	0.0040	0.0099	0.0092	0.0063		0.0044	0.0021	0.0080	0.0064	0.0024	0.0059	0.0027
	13	0.0053	0.0019	0.0012	0.0021		0.0065	0.0016	0.0043		0.0003	0.0029	0.0021
	14		0.0042									0.0042	0.0000
	15		0.0002									0.0002	0.0000
	16		0.0004									0.0004	0.0000
	17		0.0061									0.0061	0.0000
	18		0.0047									0.0047	0.0000
	Total	0.0649	0.0910	0.0707	0.0634	0.0334	0.0660	0.0617	0.0751	0.0736	0.0695	0.0669	0.0137

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.0000							0.0000	0.0000
	3				0.0000							0.0000	0.0000
	4	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0000
	5	0.0032	0.0027	0.0028	0.0026	0.0032	0.0027	0.0027	0.0027	0.0031	0.0033	0.0029	0.0003
	6	0.0045	0.0053	0.0044	0.0041	0.0045	0.0041	0.0042	0.0095	0.0042	0.0055	0.0050	0.0016
	7	0.0045	0.0059	0.0064	0.0049	0.0013	0.0047	0.0044	0.0066	0.0059	0.0075	0.0052	0.0016
	8	0.0029	0.0026	0.0012	0.0044	0.0000	0.0035	0.0031	0.0079	0.0006	0.0006	0.0027	0.0022
	9	0.0025	0.0025	0.0029	0.0031		0.0023	0.0027	0.0033	0.0006	0.0039	0.0026	0.0009
	10	0.0002	0.0002	0.0010	0.0024	0.0000	0.0037	0.0017	0.0011	0.0009	0.0012	0.0012	0.0011
	11		0.0010	0.0008		0.0000		0.0006	0.0005		0.0007	0.0006	0.0003
	12		0.0004	0.0009	0.0005		0.0008		0.0028		0.0007	0.0010	0.0008
	13			0.0010					0.0022		0.0022	0.0018	0.0006
	Total	0.0179	0.0206	0.0215	0.0222	0.0092	0.0218	0.0195	0.0368	0.0155	0.0256	0.0211	0.0068
N	5	0.0004	0.0003	0.0003	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003	0.0004	0.0001
	6	0.0047	0.0036	0.0035	0.0049	0.0056	0.0048	0.0048	0.0038	0.0036	0.0038	0.0043	0.0007
	7	0.0137	0.0068	0.0071	0.0091	0.0079	0.0091	0.0101	0.0076	0.0068	0.0064	0.0085	0.0021
	8	0.0142	0.0127	0.0128	0.0124	0.0018	0.0122	0.0132	0.0129	0.0112	0.0150	0.0118	0.0035
	9	0.0125	0.0133	0.0119	0.0093	0.0141	0.0098	0.0122	0.0140	0.0109	0.0110	0.0119	0.0016
	10	0.0453	0.0054	0.0055	0.0062		0.0049	0.0017	0.0035	0.0044	0.0067	0.0093	0.0128
	11	0.0137	0.0089	0.0016	0.0031		0.0005	0.0010	0.0020	0.0006	0.0002	0.0035	0.0044
	12		0.0025	0.0002						0.0009	0.0046	0.0020	0.0017
	13				0.0004		0.0013	0.0024				0.0013	0.0008
	Total	0.1046	0.0534	0.0429	0.0457	0.0299	0.0431	0.0457	0.0440	0.0386	0.0480	0.0496	0.0192
A	6	0.0024	0.0022	0.0022	0.0024	0.0028	0.0022	0.0022	0.0022	0.0023	0.0024	0.0023	0.0002
	7	0.0811	0.0841	0.0809	0.0862	0.1031	0.0824	0.0835	0.0808	0.0809	0.0866	0.0850	0.0064
	8	0.1907	0.2050	0.1827	0.2009	0.2453	0.2000	0.1929	0.1797	0.1731	0.1955	0.1966	0.0188
	9	0.4617	0.4790	0.4423	0.4660	0.5448	0.4918	0.4517	0.4341	0.4280	0.4820	0.4682	0.0324
	10	0.4931	0.4605	0.4912	0.4132	0.2377	0.4885	0.4919	0.3568	0.2543	0.3847	0.4072	0.0929
	11	0.2109	0.3483	0.2426	0.3588	0.0993	0.4181	0.4104	0.2117	0.1401	0.3145	0.2755	0.1054
	12	0.3074	0.3263	0.1353	0.2924	0.0365	0.2883	0.2981	0.1292	0.1259	0.1012	0.2041	0.1022
	13		0.1627		0.0230		0.0608	0.0333				0.0700	0.0553
	14		0.0195		0.0337		0.0826					0.0453	0.0270
	15				0.0015							0.0015	0.0000
	Total	1.7472	2.0876	1.5772	1.8783	1.2695	2.1149	1.9640	1.3947	1.2045	1.5670	1.6805	0.3129
X	1				0.0000							0.0000	0.0000
	2	0.0105	0.0120	0.0122	0.0122	0.0103	0.0121	0.0119	0.0114	0.0120		0.0116	0.0007
	4				0.0000							0.0000	0.0000
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0105	0.0120	0.0122	0.0122	0.0103	0.0121	0.0119	0.0115	0.0120		0.0116	0.0007
U*	0	0.0075	0.0289	0.3668	0.1381	0.0182	0.1001	0.1089	0.1551	0.4110	0.3499	0.1684	0.1444
	15+							0.2418				0.2418	0.0000
	Total	0.0075	0.0289	0.3668	0.1381	0.0182	0.1001	0.3507	0.1551	0.4110	0.3499	0.1926	0.1524
Grand Total		1.9770	2.3334	2.1164	2.1879	1.3890	2.4265	2.4813	1.7398	1.7905	2.0881	2.0530	0.3223

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-5

DHA PMI Results of Fuel 5 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2			0.0000								0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000			0.0000	0.0000	0.0000
	4	0.0005	0.0003	0.0003	0.0003	0.0004	0.0002	0.0003	0.0003	0.0002	0.0003	0.0003	0.0001
	5	0.0024	0.0018	0.0017	0.0018	0.0022	0.0015	0.0017	0.0018	0.0016	0.0019	0.0018	0.0003
	6	0.0017	0.0015	0.0015	0.0016	0.0019	0.0014	0.0015	0.0016	0.0015	0.0016	0.0016	0.0001
	7	0.0015	0.0016	0.0016	0.0017	0.0022	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017	0.0002
	8	0.0011	0.0012	0.0013	0.0013	0.0015	0.0014	0.0013	0.0015	0.0014	0.0014	0.0014	0.0001
	9	0.0007	0.0010	0.0009	0.0009		0.0010	0.0009	0.0009	0.0010	0.0010	0.0009	0.0001
	10	0.0009	0.0012	0.0010	0.0009	0.0000	0.0011	0.0009	0.0009	0.0011	0.0010	0.0009	0.0003
	11	0.0006	0.0010	0.0013	0.0010	0.0000	0.0012	0.0010	0.0011	0.0011	0.0013	0.0010	0.0004
	12	0.0003	0.0006	0.0007	0.0009		0.0007	0.0007	0.0006	0.0007	0.0011	0.0007	0.0002
	13		0.0003	0.0004	0.0003	0.0000	0.0006	0.0005		0.0017	0.0003	0.0005	0.0005
	14		0.0006				0.0005	0.0004		0.0015	0.0003	0.0006	0.0004
	15		0.0005				0.0005	0.0008				0.0006	0.0001
	16		0.0006									0.0006	0.0000
	17		0.0017									0.0017	0.0000
	18		0.0016									0.0016	0.0000
	Total	0.0097	0.0153	0.0108	0.0106	0.0083	0.0117	0.0117	0.0103	0.0134	0.0121	0.0114	0.0019
I	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0041	0.0029	0.0027	0.0029	0.0036	0.0024	0.0028	0.0030	0.0024	0.0030	0.0030	0.0005
	6	0.0055	0.0044	0.0043	0.0046	0.0056	0.0041	0.0044	0.0046	0.0044	0.0042	0.0046	0.0005
	7	0.0062	0.0059	0.0060	0.0062	0.0072	0.0060	0.0061	0.0063	0.0063	0.0063	0.0063	0.0003
	8	0.0305	0.0389	0.0394	0.0247	0.0241	0.0434	0.0354	0.0394	0.0402	0.0416	0.0358	0.0066
	9	0.0072	0.0076	0.0094	0.0102	0.0000	0.0086	0.0079	0.0099	0.0091	0.0094	0.0079	0.0028
	10	0.0053	0.0078	0.0089	0.0036	0.0031	0.0060	0.0069	0.0085	0.0076	0.0065	0.0064	0.0019
	11	0.0070	0.0139	0.0067	0.0150		0.0197	0.0105	0.0053	0.0069	0.0076	0.0103	0.0046
	12	0.0011	0.0047	0.0034	0.0053		0.0044	0.0024	0.0028	0.0032	0.0007	0.0031	0.0015
	13	0.0010	0.0001	0.0001	0.0015		0.0116	0.0006	0.0008		0.0002	0.0020	0.0037
	14		0.0007									0.0007	0.0000
	15		0.0009									0.0009	0.0000
	16		0.0003									0.0003	0.0000
	17		0.0002									0.0002	0.0000
	18		0.0003									0.0003	0.0000
	Total	0.0679	0.0886	0.0810	0.0740	0.0436	0.1063	0.0771	0.0807	0.0801	0.0795	0.0779	0.0150

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2				0.0000							0.0000	0.0000
	3		0.0000	0.0000	0.0000						0.0000	0.0000	0.0000
	4	0.0000	0.0001	0.0001	0.0001		0.0000	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000
	5	0.0024	0.0019	0.0019	0.0017	0.0021	0.0015	0.0017	0.0019	0.0019	0.0030	0.0020	0.0004
	6	0.0026	0.0031	0.0028	0.0023	0.0020	0.0021	0.0024	0.0030	0.0026	0.0035	0.0026	0.0005
	7	0.0014	0.0041	0.0027	0.0019	0.0000	0.0016	0.0017	0.0026	0.0028	0.0048	0.0024	0.0013
	8	0.0140	0.0025	0.0005	0.0015	0.0000	0.0005	0.0011	0.0026	0.0002	0.0002	0.0023	0.0040
	9	0.0000	0.0029	0.0009	0.0022		0.0007	0.0006	0.0003	0.0012	0.0018	0.0012	0.0009
	10	0.0014	0.0001	0.0010	0.0004	0.0000	0.0030	0.0011		0.0002	0.0023	0.0011	0.0010
	11		0.0007	0.0009		0.0000	0.0009	0.0012	0.0008		0.0029	0.0011	0.0008
	12		0.0005	0.0003							0.0001	0.0003	0.0002
	13			0.0007							0.0006	0.0006	0.0001
	Total	0.0219	0.0159	0.0117	0.0101	0.0041	0.0103	0.0098	0.0112	0.0090	0.0192	0.0123	0.0050
N	5	0.0006	0.0004	0.0004	0.0005	0.0007	0.0004	0.0005	0.0004	0.0004	0.0004	0.0005	0.0001
	6	0.0043	0.0031	0.0031	0.0042	0.0050	0.0038	0.0042	0.0034	0.0032	0.0034	0.0038	0.0006
	7	0.0057	0.0045	0.0045	0.0341	0.0040	0.0056	0.0069	0.0048	0.0047	0.0036	0.0078	0.0088
	8	0.0040	0.0069	0.0053	0.0036	0.0067	0.0058	0.0061	0.0053	0.0054	0.0057	0.0055	0.0010
	9	0.0009	0.0115	0.0056	0.0022	0.0000	0.0050	0.0050	0.0038	0.0087	0.0055	0.0048	0.0033
	10	0.0132	0.0054	0.0029	0.0027		0.0020	0.0008	0.0019	0.0022	0.0044	0.0039	0.0035
	11	0.0054	0.0043	0.0004	0.0017			0.0005	0.0043	0.0046	0.0003	0.0027	0.0020
	12			0.0001						0.0002	0.0013	0.0005	0.0005
	13							0.0024				0.0024	0.0000
	Total	0.0340	0.0361	0.0222	0.0491	0.0163	0.0226	0.0264	0.0240	0.0294	0.0246	0.0285	0.0088
A	6	0.0029	0.0026	0.0026	0.0028	0.0034	0.0023	0.0027	0.0026	0.0028	0.0028	0.0028	0.0002
	7	0.1220	0.1263	0.1249	0.1240	0.1617	0.1171	0.1441	0.1248	0.1323	0.1332	0.1310	0.0124
	8	0.2440	0.2889	0.2708	0.2915	0.3727	0.3200	0.2905	0.2636	0.2735	0.2861	0.2901	0.0335
	9	0.1850	0.2296	0.2278	0.2288	0.2823	0.2822	0.2417	0.2139	0.2486	0.2404	0.2380	0.0277
	10	0.1183	0.1985	0.2413	0.1861	0.0601	0.2356	0.2089	0.2293	0.1548	0.2446	0.1878	0.0574
	11	0.0267	0.0898	0.0687	0.0866	0.0000	0.1383	0.1321	0.0552	0.0662	0.0891	0.0753	0.0404
	12	0.0102	0.0763	0.0392	0.0335	0.0000	0.0786	0.0871	0.0298	0.0821	0.0200	0.0457	0.0308
	13		0.0164		0.0575			0.0164				0.0301	0.0194
	14												
	15												
	Total	0.7091	1.0287	0.9753	1.0109	0.8801	1.1741	1.1234	0.9192	0.9603	1.0162	0.9797	0.1226
X	2	0.0126	0.0119	0.0124	0.0125	0.0112	0.0118	0.0122	0.0118	0.0120		0.0120	0.0004
	3												
	4												
	5								0.0001			0.0001	0.0000
	6		0.0000									0.0000	0.0000
	Total	0.0126	0.0120	0.0124	0.0125	0.0112	0.0118	0.0122	0.0118	0.0120		0.0121	0.0004
U*	0	0.0001	0.0051	0.1617	0.0458	0.0000	0.0164	0.0411	0.0324	0.1151	0.0806	0.0498	0.0512
	15+							0.0878				0.0878	0.0000
	Total	0.0001	0.0051	0.1617	0.0458	0.0000	0.0164	0.1288	0.0324	0.1151	0.0806	0.0586	0.0562
Grand Total		0.8555	1.2016	1.2752	1.2129	0.9636	1.3530	1.3895	1.0896	1.2192	1.2322	1.1792	0.1578

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-6

DHA PMI Results of Fuel 6a by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2								0.0000			0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000
	4	0.0013	0.0007	0.0006	0.0008	0.0001	0.0003	0.0007	0.0008	0.0007	0.0006	0.0007	0.0003
	5	0.0040	0.0031	0.0029	0.0032	0.0017	0.0023	0.0031	0.0032	0.0030	0.0031	0.0030	0.0006
	6	0.0035	0.0035	0.0034	0.0036	0.0033	0.0033	0.0035	0.0035	0.0034	0.0038	0.0035	0.0001
	7	0.0010	0.0022	0.0023	0.0023	0.0045	0.0024	0.0023	0.0022	0.0022	0.0025	0.0024	0.0008
	8	0.0016	0.0022	0.0020	0.0019	0.0045	0.0022	0.0019	0.0018	0.0020	0.0021	0.0022	0.0008
	9	0.0011	0.0016	0.0015	0.0014	0.0043	0.0018	0.0015	0.0016	0.0016	0.0017	0.0018	0.0008
	10	0.0009	0.0013	0.0012	0.0010	0.0000	0.0015	0.0011	0.0015	0.0011	0.0012	0.0011	0.0004
	11	0.0005	0.0010	0.0011	0.0009	0.0001	0.0015	0.0008	0.0010	0.0009	0.0013	0.0009	0.0004
	12	0.0003	0.0007	0.0008	0.0023		0.0032	0.0011	0.0010	0.0010	0.0030	0.0015	0.0010
	13	0.0003	0.0013	0.0010	0.0011	0.0001	0.0016	0.0016		0.0129	0.0133	0.0037	0.0051
	14		0.0020				0.0075	0.0014		0.0108	0.0011	0.0046	0.0039
	15		0.0007		0.0011		0.0005	0.0023				0.0012	0.0007
	16												
	17												
	18												
	Total	0.0145	0.0204	0.0169	0.0199	0.0186	0.0283	0.0212	0.0165	0.0396	0.0336	0.0229	0.0078
I	4	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000
	5	0.0053	0.0037	0.0033	0.0038	0.0028	0.0027	0.0037	0.0038	0.0036	0.0036	0.0036	0.0007
	6	0.0067	0.0058	0.0056	0.0060	0.0068	0.0054	0.0056	0.0058	0.0057	0.0060	0.0059	0.0004
	7	0.0074	0.0074	0.0075	0.0076	0.0108	0.0078	0.0074	0.0076	0.0074	0.0079	0.0079	0.0010
	8	0.0097	0.0100	0.0115	0.0099	0.0123	0.0126	0.0103	0.0096	0.0111	0.0120	0.0109	0.0011
	9	0.0062	0.0073	0.0094	0.0079	0.0010	0.0085	0.0077	0.0088	0.0103	0.0095	0.0077	0.0025
	10	0.0039	0.0085	0.0089	0.0055	0.0000	0.0068	0.0079	0.0104	0.0108	0.0067	0.0069	0.0031
	11	0.0025	0.0080	0.0057	0.0042		0.0074	0.0046	0.0106	0.0067	0.0104	0.0067	0.0026
	12	0.0007	0.0096	0.0110	0.0048		0.0033	0.0012	0.0093	0.0075	0.0052	0.0058	0.0035
	13	0.0010	0.0022	0.0008	0.0014		0.0064	0.0025	0.0036		0.0012	0.0024	0.0018
	14		0.0069									0.0069	0.0000
	15		0.0013									0.0013	0.0000
	16		0.0006									0.0006	0.0000
	17		0.0020									0.0020	0.0000
	18		0.0002									0.0002	0.0000
	Total	0.0436	0.0736	0.0638	0.0513	0.0337	0.0610	0.0509	0.0695	0.0632	0.0626	0.0573	0.0116

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3												
	4	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
	5	0.0024	0.0018	0.0018	0.0017	0.0032	0.0012	0.0017	0.0019	0.0021	0.0021	0.0020	0.0005
	6	0.0024	0.0031	0.0027	0.0021	0.0045	0.0019	0.0024	0.0027	0.0018	0.0034	0.0027	0.0008
	7	0.0016	0.0042	0.0036	0.0025	0.0012	0.0029	0.0023	0.0036	0.0040	0.0052	0.0031	0.0012
	8	0.0022	0.0036	0.0008	0.0037	0.0000	0.0009	0.0017	0.0053	0.0003	0.0003	0.0019	0.0017
	9	0.0004	0.0018	0.0017	0.0013		0.0019	0.0014	0.0016	0.0007	0.0021	0.0014	0.0005
	10	0.0003	0.0001	0.0005	0.0009	0.0000	0.0036	0.0014	0.0006	0.0005	0.0009	0.0009	0.0010
	11		0.0007	0.0006		0.0000		0.0006	0.0014		0.0006	0.0006	0.0004
	12		0.0003	0.0008	0.0001		0.0008				0.0007	0.0005	0.0003
	13			0.0010					0.0040		0.0041	0.0031	0.0014
	Total	0.0094	0.0157	0.0135	0.0123	0.0091	0.0132	0.0117	0.0212	0.0096	0.0195	0.0135	0.0040
N	5	0.0009	0.0006	0.0006	0.0008	0.0005	0.0007	0.0008	0.0007	0.0006	0.0007	0.0007	0.0001
	6	0.0085	0.0076	0.0075	0.0089	0.0055	0.0082	0.0086	0.0079	0.0075	0.0081	0.0078	0.0009
	7	0.0121	0.0076	0.0086	0.0093	0.0079	0.0099	0.0107	0.0086	0.0076	0.0082	0.0090	0.0014
	8	0.0083	0.0099	0.0113	0.0094	0.0000	0.0144	0.0125	0.0133	0.0101	0.0112	0.0100	0.0038
	9	0.0039	0.0146	0.0094	0.0070	0.0140	0.0116	0.0107	0.0104	0.0088	0.0094	0.0100	0.0030
	10	0.0323	0.0046	0.0043	0.0038		0.0033	0.0015	0.0034	0.0017	0.0067	0.0068	0.0091
	11	0.0133	0.0077	0.0012	0.0018		0.0001	0.0005	0.0014	0.0006	0.0007	0.0030	0.0042
	12		0.0037	0.0002						0.0005	0.0043	0.0022	0.0019
	13							0.0011				0.0011	0.0000
	Total	0.0793	0.0563	0.0431	0.0410	0.0280	0.0484	0.0464	0.0455	0.0374	0.0492	0.0475	0.0128
A	6	0.0058	0.0056	0.0056	0.0060	0.0028	0.0051	0.0057	0.0055	0.0066	0.0060	0.0055	0.0010
	7	0.0592	0.0668	0.0672	0.0694	0.1029	0.0706	0.0701	0.0645	0.0679	0.0720	0.0711	0.0112
	8	0.1304	0.1704	0.1621	0.1712	0.2450	0.2012	0.1654	0.1492	0.1498	0.1718	0.1716	0.0301
	9	0.2167	0.2929	0.2787	0.2880	0.5447	0.3777	0.2823	0.2579	0.2710	0.3007	0.3111	0.0867
	10	0.3287	0.4408	0.4620	0.3800	0.2499	0.4945	0.4243	0.3414	0.2104	0.4734	0.3806	0.0917
	11	0.0759	0.4624	0.3670	0.4729	0.0997	0.7154	0.5238	0.2610	0.1321	0.3554	0.3466	0.1962
	12	0.2230	0.5371	0.1294	0.5033	0.0364	0.7529	0.4833	0.1224	0.1276	0.0828	0.2998	0.2344
	13		0.1070		0.0190		0.1219	0.0380				0.0715	0.0438
	14				0.0020		0.0314					0.0167	0.0147
	15												
	Total	1.0396	2.0830	1.4720	1.9118	1.2814	2.7708	1.9928	1.2019	0.9654	1.4622	1.6181	0.5352
X	2	0.0121	0.0127	0.0130	0.0129	0.0117	0.0134	0.0125	0.0117	0.0125		0.0125	0.0006
	3												
	4												
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0121	0.0128	0.0130	0.0129	0.0117	0.0134	0.0125	0.0117	0.0125		0.0125	0.0006
U*	0	0.0005	0.0062	0.4643	0.0546	0.0128	0.0322	0.1331	0.2771	0.5627	0.4152	0.1959	0.2049
	15+							0.1306				0.1306	0.0000
	Total	0.0005	0.0062	0.4643	0.0546	0.0128	0.0322	0.2637	0.2771	0.5627	0.4152	0.2089	0.2046
Grand Total		1.1989	2.2680	2.0866	2.1037	1.3952	2.9673	2.3992	1.6435	1.6904	2.0423	1.9795	0.4912

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-7

DHA PMI Results of Fuel 6b by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	2								0.0000			0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000		0.0000	0.0000
	4	0.0013	0.0007	0.0006	0.0007		0.0003	0.0007	0.0006	0.0006	0.0007	0.0007	0.0002
	5	0.0043	0.0031	0.0029	0.0032		0.0024	0.0031	0.0030	0.0029	0.0032	0.0031	0.0005
	6	0.0037	0.0036	0.0034	0.0037		0.0033	0.0035	0.0036	0.0035	0.0038	0.0036	0.0001
	7	0.0009	0.0023	0.0023	0.0024		0.0024	0.0022	0.0023	0.0023	0.0025	0.0022	0.0004
	8	0.0014	0.0019	0.0020	0.0019		0.0022	0.0018	0.0019	0.0020	0.0022	0.0019	0.0002
	9	0.0010	0.0016	0.0015	0.0014		0.0018	0.0015	0.0015	0.0016	0.0017	0.0015	0.0002
	10	0.0008	0.0012	0.0012	0.0010		0.0014	0.0011	0.0014	0.0012	0.0012	0.0012	0.0002
	11	0.0004	0.0011	0.0009	0.0009		0.0015	0.0008	0.0014	0.0009	0.0013	0.0010	0.0003
	12	0.0014	0.0007	0.0007	0.0023		0.0025	0.0011	0.0010	0.0010	0.0029	0.0015	0.0008
	13	0.0016	0.0010	0.0010			0.0014	0.0016		0.0131	0.0137	0.0048	0.0055
	14	0.0022	0.0018				0.0077	0.0014		0.0113	0.0011	0.0042	0.0039
	15		0.0003		0.0017		0.0007	0.0007				0.0008	0.0005
	16						0.0006					0.0006	0.0000
	17						0.0017					0.0017	0.0000
	18												
	Total	0.0191	0.0194	0.0165	0.0192		0.0301	0.0195	0.0166	0.0403	0.0343	0.0239	0.0082
I	4	0.0002	0.0001	0.0000	0.0001		0.0000	0.0001	0.0000	0.0000	0.0001	0.0001	0.0000
	5	0.0055	0.0037	0.0034	0.0037		0.0027	0.0037	0.0035	0.0034	0.0038	0.0037	0.0007
	6	0.0068	0.0058	0.0056	0.0060		0.0055	0.0057	0.0059	0.0057	0.0061	0.0059	0.0004
	7	0.0068	0.0075	0.0074	0.0077		0.0077	0.0074	0.0078	0.0075	0.0080	0.0075	0.0003
	8	0.0079	0.0109	0.0114	0.0101		0.0125	0.0103	0.0098	0.0113	0.0122	0.0107	0.0013
	9	0.0052	0.0071	0.0091	0.0081		0.0082	0.0077	0.0091	0.0106	0.0096	0.0083	0.0015
	10	0.0034	0.0080	0.0087	0.0056		0.0073	0.0080	0.0091	0.0109	0.0063	0.0075	0.0021
	11	0.0024	0.0074	0.0057	0.0040		0.0070	0.0044	0.0059	0.0069	0.0092	0.0059	0.0019
	12	0.0007	0.0077	0.0111	0.0052		0.0031	0.0013	0.0100	0.0076	0.0051	0.0058	0.0034
	13	0.0013	0.0014	0.0005	0.0012		0.0073	0.0023	0.0041		0.0011	0.0024	0.0021
	14		0.0078									0.0078	0.0000
	15		0.0014									0.0014	0.0000
	16		0.0006									0.0006	0.0000
	17		0.0019									0.0019	0.0000
	18		0.0009									0.0009	0.0000
	Total	0.0402	0.0720	0.0630	0.0517		0.0612	0.0509	0.0651	0.0640	0.0614	0.0589	0.0090

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.0000								0.0000	0.0000
	4	0.0001	0.0001	0.0001	0.0001		0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
	5	0.0025	0.0019	0.0018	0.0017		0.0013	0.0017	0.0019	0.0021	0.0022	0.0019	0.0003
	6	0.0023	0.0032	0.0027	0.0021		0.0020	0.0022	0.0030	0.0018	0.0033	0.0025	0.0005
	7	0.0015	0.0035	0.0037	0.0028		0.0026	0.0023	0.0037	0.0041	0.0049	0.0032	0.0010
	8	0.0011	0.0021	0.0007	0.0040		0.0014	0.0017	0.0052	0.0003		0.0021	0.0016
	9	0.0006	0.0033	0.0021	0.0009		0.0019	0.0013	0.0010	0.0007	0.0015	0.0015	0.0008
	10	0.0002		0.0004	0.0006		0.0036	0.0012		0.0005	0.0008	0.0011	0.0011
	11		0.0008	0.0006				0.0005	0.0005			0.0006	0.0001
	12		0.0020	0.0005	0.0004		0.0010				0.0006	0.0009	0.0006
	13								0.0029		0.0040	0.0035	0.0005
	Total	0.0085	0.0169	0.0127	0.0125		0.0138	0.0111	0.0183	0.0096	0.0174	0.0134	0.0033
N	5	0.0010	0.0006	0.0006	0.0008		0.0007	0.0008	0.0006	0.0006	0.0007	0.0007	0.0001
	6	0.0086	0.0077	0.0074	0.0090		0.0083	0.0086	0.0080	0.0075	0.0082	0.0082	0.0005
	7	0.0116	0.0077	0.0085	0.0090		0.0109	0.0107	0.0088	0.0076	0.0083	0.0092	0.0014
	8	0.0075	0.0104	0.0112	0.0098		0.0146	0.0129	0.0133	0.0103	0.0112	0.0112	0.0020
	9	0.0033	0.0140	0.0093	0.0069		0.0115	0.0113	0.0093	0.0087	0.0094	0.0093	0.0028
	10	0.0315	0.0054	0.0046	0.0036		0.0052	0.0015	0.0034	0.0018	0.0044	0.0068	0.0088
	11	0.0076	0.0074	0.0017	0.0019		0.0012	0.0005	0.0006	0.0006		0.0027	0.0028
	12		0.0036	0.0002						0.0006	0.0042	0.0021	0.0018
	13						0.0018	0.0010				0.0014	0.0004
	Total	0.0712	0.0568	0.0435	0.0411		0.0541	0.0473	0.0440	0.0377	0.0463	0.0491	0.0096
A	6	0.0058	0.0057	0.0056	0.0061		0.0052	0.0056	0.0055	0.0067	0.0061	0.0058	0.0004
	7	0.0577	0.0675	0.0667	0.0712		0.0705	0.0699	0.0662	0.0688	0.0723	0.0679	0.0041
	8	0.1247	0.1699	0.1613	0.1741		0.2000	0.1655	0.1560	0.1520	0.1739	0.1642	0.0191
	9	0.2085	0.2864	0.2784	0.2905		0.3771	0.2818	0.2713	0.2751	0.3047	0.2860	0.0409
	10	0.3186	0.4088	0.4618	0.3792		0.5733	0.3971	0.4677	0.2139	0.4580	0.4087	0.0960
	11	0.1357	0.4114	0.3661	0.4907		0.7053	0.5388	0.2401	0.1351	0.3600	0.3759	0.1776
	12	0.2736	0.5244	0.1270	0.4728		0.6510	0.5008	0.1254	0.1303	0.0845	0.3211	0.2044
	13		0.0972		0.0255		0.1285	0.0346				0.0714	0.0430
	14				0.0057		0.0361					0.0209	0.0152
	15												
	Total	1.1246	1.9713	1.4668	1.9157		2.7469	1.9942	1.3322	0.9819	1.4595	1.6659	0.5149
X	2	0.0132	0.0130	0.0129	0.0129		0.0132	0.0125	0.0122	0.0126		0.0128	0.0003
	3												
	4												
	5								0.0001			0.0001	0.0000
	6		0.0001		0.0000							0.0000	0.0000
	Total	0.0132	0.0131	0.0129	0.0129		0.0132	0.0125	0.0123	0.0126		0.0128	0.0003
U*	0	0.0271	0.0030	0.4575	0.0749		0.0435	0.1342	0.2423	0.6003	0.2529	0.2040	0.1956
	15+							0.1203				0.1203	0.0000
	Total	0.0271	0.0030	0.4575	0.0749		0.0435	0.2545	0.2423	0.6003	0.2529	0.2173	0.1945
Grand Total		1.3039	2.1524	2.0729	2.1281		2.9629	2.3900	1.7308	1.7466	1.8718	2.0399	0.4406

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-8

DHA PMI Results of Fuel 7 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1				0.0000							0.0000	0.0000
	2				0.0000							0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000				0.0000	0.0000
	4	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
	5	0.0016	0.0012	0.0011	0.0013	0.0017	0.0011	0.0012	0.0012	0.0012	0.0013	0.0013	0.0002
	6	0.0019	0.0018	0.0017	0.0018	0.0024	0.0017	0.0017	0.0017	0.0017	0.0019	0.0018	0.0002
	7	0.0011	0.0021	0.0021	0.0022	0.0030	0.0022	0.0021	0.0021	0.0021	0.0023	0.0021	0.0004
	8	0.0023	0.0027	0.0026	0.0027	0.0035	0.0026	0.0026	0.0025	0.0025	0.0027	0.0027	0.0003
	9	0.0025	0.0029	0.0028	0.0028	0.0036	0.0032	0.0028	0.0027	0.0030	0.0031	0.0029	0.0003
	10	0.0029	0.0038	0.0034	0.0031	0.0000	0.0040	0.0032	0.0038	0.0033	0.0040	0.0031	0.0011
	11	0.0040	0.0053	0.0053	0.0046	0.0004	0.0059	0.0049	0.0054	0.0051	0.0058	0.0047	0.0015
	12	0.0037	0.0048	0.0055	0.0057		0.0067	0.0054	0.0049	0.0051	0.0070	0.0054	0.0009
	13	0.0047	0.0033	0.0036	0.0034	0.0000	0.0048	0.0037	0.0034	0.0044	0.0038	0.0035	0.0013
	14	0.0003	0.0013				0.0015	0.0014		0.0021	0.0013	0.0013	0.0005
	15	0.0008	0.0020		0.0020		0.0018	0.0020				0.0017	0.0005
	16		0.0030		0.0005		0.0030					0.0022	0.0012
	17		0.0094									0.0094	0.0000
	18		0.0146									0.0146	0.0000
	Total	0.0259	0.0583	0.0282	0.0302	0.0148	0.0385	0.0312	0.0279	0.0305	0.0331	0.0319	0.0105
I	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0033	0.0024	0.0021	0.0025	0.0033	0.0022	0.0023	0.0023	0.0022	0.0024	0.0025	0.0004
	6	0.0057	0.0046	0.0044	0.0048	0.0064	0.0045	0.0045	0.0045	0.0046	0.0048	0.0049	0.0006
	7	0.0077	0.0073	0.0071	0.0077	0.0097	0.0074	0.0073	0.0075	0.0073	0.0077	0.0077	0.0007
	8	0.0313	0.0398	0.0398	0.0405	0.0371	0.0445	0.0392	0.0391	0.0405	0.0424	0.0394	0.0033
	9	0.0160	0.0170	0.0195	0.0189	0.0025	0.0153	0.0158	0.0197	0.0200	0.0193	0.0164	0.0049
	10	0.0124	0.0157	0.0179	0.0126	0.0041	0.0141	0.0148	0.0205	0.0151	0.0150	0.0142	0.0041
	11	0.0158	0.0220	0.0145	0.0188		0.0285	0.0178	0.0179	0.0130	0.0134	0.0180	0.0046
	12	0.0067	0.0164	0.0134	0.0093		0.0090	0.0050	0.0116	0.0080	0.0036	0.0092	0.0038
	13	0.0084	0.0024	0.0013	0.0025		0.0065	0.0028	0.0006		0.0009	0.0032	0.0026
	14		0.0052									0.0052	0.0000
	15		0.0010									0.0010	0.0000
	16												
	17												
	18		0.0016									0.0016	0.0000
	Total	0.1074	0.1355	0.1199	0.1177	0.0632	0.1322	0.1094	0.1237	0.1108	0.1095	0.1129	0.0190

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3												
	4	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
	5	0.0027	0.0022	0.0020	0.0020	0.0028	0.0018	0.0020	0.0023	0.0023	0.0025	0.0023	0.0003
	6	0.0045	0.0058	0.0047	0.0040	0.0048	0.0037	0.0041	0.0049	0.0045	0.0061	0.0047	0.0007
	7	0.0036	0.0056	0.0060	0.0044	0.0006	0.0036	0.0035	0.0063	0.0062	0.0083	0.0048	0.0020
	8	0.0175	0.0034	0.0012	0.0064	0.0016	0.0019	0.0027	0.0059	0.0004	0.0002	0.0041	0.0049
	9	0.0040	0.0037	0.0030	0.0048		0.0055	0.0024	0.0030	0.0022	0.0043	0.0037	0.0010
	10	0.0006	0.0001	0.0016	0.0029	0.0000	0.0062	0.0031	0.0025	0.0009	0.0023	0.0020	0.0018
	11		0.0016	0.0020		0.0000		0.0018	0.0018		0.0026	0.0016	0.0008
	12		0.0043	0.0021	0.0017		0.0022		0.0023		0.0024	0.0025	0.0008
	13			0.0008					0.0023		0.0030	0.0020	0.0009
	Total	0.0329	0.0267	0.0236	0.0264	0.0098	0.0249	0.0198	0.0313	0.0166	0.0317	0.0244	0.0069
N	5	0.0006	0.0004	0.0004	0.0005	0.0007	0.0005	0.0005	0.0004	0.0004	0.0004	0.0005	0.0001
	6	0.0067	0.0045	0.0043	0.0064	0.0081	0.0060	0.0063	0.0045	0.0043	0.0047	0.0056	0.0012
	7	0.0185	0.0113	0.0115	0.0129	0.0128	0.0134	0.0162	0.0122	0.0110	0.0101	0.0130	0.0024
	8	0.0188	0.0208	0.0182	0.0182	0.0165	0.0207	0.0209	0.0202	0.0160	0.0183	0.0189	0.0017
	9	0.0120	0.0229	0.0200	0.0178	0.0000	0.0163	0.0207	0.0203	0.0220	0.0233	0.0175	0.0067
	10	0.0438	0.0145	0.0090	0.0079		0.0062	0.0035	0.0075	0.0040	0.0185	0.0128	0.0119
	11	0.0144	0.0068	0.0026	0.0031		0.0069	0.0015	0.0033	0.0048	0.0026	0.0051	0.0037
	12	0.0016	0.0033	0.0008			0.0005				0.0047	0.0022	0.0016
	13				0.0003			0.0028				0.0015	0.0012
	Total	0.1164	0.0845	0.0667	0.0671	0.0381	0.0705	0.0724	0.0683	0.0625	0.0826	0.0729	0.0188
A	6	0.0038	0.0032	0.0031	0.0035	0.0045	0.0029	0.0032	0.0031	0.0032	0.0034	0.0034	0.0004
	7	0.0308	0.0311	0.0305	0.0287	0.0426	0.0226	0.0334	0.0310	0.0296	0.0324	0.0313	0.0047
	8	0.0940	0.1074	0.0986	0.1091	0.1431	0.1129	0.1008	0.0940	0.0909	0.1041	0.1055	0.0143
	9	0.1786	0.2015	0.1862	0.2016	0.2777	0.2376	0.2065	0.1637	0.2043	0.2059	0.2063	0.0302
	10	0.2394	0.3154	0.4030	0.2933	0.1753	0.3918	0.3631	0.4083	0.2353	0.4416	0.3266	0.0845
	11	0.0987	0.2471	0.1642	0.2684	0.0893	0.3606	0.3640	0.1462	0.1311	0.2194	0.2089	0.0952
	12	0.1756	0.2102	0.1257	0.2008	0.0599	0.1806	0.2421	0.1277	0.1376	0.0753	0.1536	0.0558
	13		0.0300		0.0032		0.0011	0.0353				0.0174	0.0154
	14		0.0609		0.0057							0.0333	0.0276
	15												
	Total	0.8207	1.2068	1.0115	1.1144	0.7923	1.3100	1.3485	0.9741	0.8319	1.0820	1.0492	0.1898
X	2	0.0129	0.0127	0.0125	0.0124	0.0136	0.0127	0.0121	0.0115	0.0121		0.0125	0.0006
	3				0.0000							0.0000	0.0000
	4				0.0000				0.0004			0.0002	0.0002
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0129	0.0128	0.0125	0.0124	0.0136	0.0127	0.0121	0.0120	0.0121		0.0126	0.0005
U*	0	0.1304	0.0098	0.3918	0.1901		0.3919	0.1642	0.1606	0.4474	0.2044	0.2323	0.1372
	15+							0.1496				0.1496	0.0000
	Total	0.1304	0.0098	0.3918	0.1901	0.0000	0.3919	0.3138	0.1606	0.4474	0.2044	0.2240	0.1499
Grand Total		1.2467	1.5344	1.6542	1.5584	0.9318	1.9807	1.9071	1.3980	1.5117	1.5433	1.5266	0.2859

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

Appendix IV-9

DHA PMI Results of Fuel 8 by PIONA Group Type and Carbon Number

Shaded cells indicate outlier points

(P = n-paraffins; I = i-paraffins; O = olefins; N = naphthenes; A = aromatics; X = oxygenates; U = unidentified)

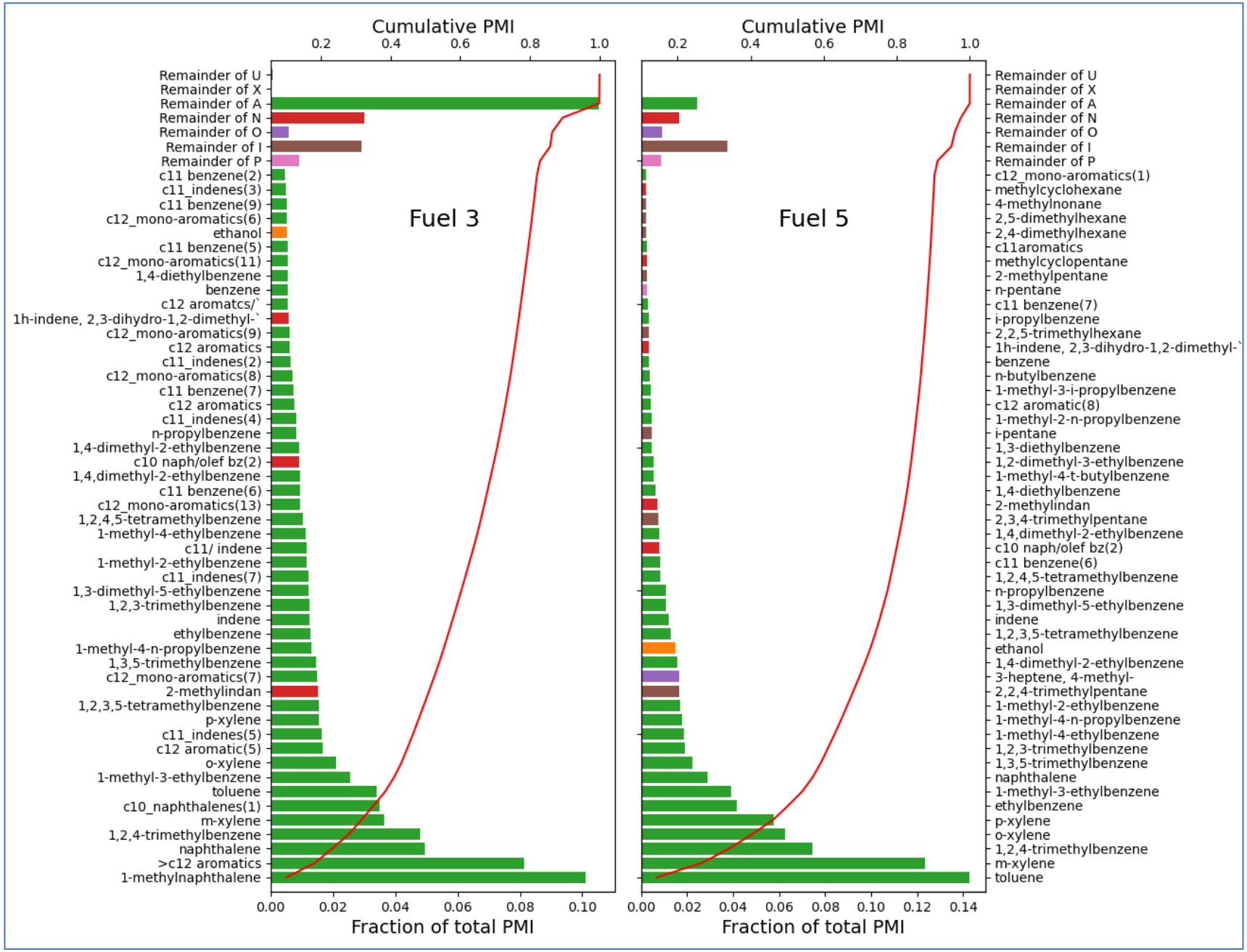
PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
P	1												
	2								0.0000			0.0000	0.0000
	3	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000		0.0000	0.0000
	4	0.0011	0.0011	0.0009	0.0011	0.0014	0.0008	0.0011	0.0011	0.0009	0.0011	0.0010	0.0002
	5	0.0020	0.0019	0.0017	0.0020	0.0024	0.0017	0.0019	0.0019	0.0018	0.0020	0.0019	0.0002
	6	0.0021	0.0021	0.0020	0.0022	0.0027	0.0020	0.0020	0.0021	0.0020	0.0023	0.0022	0.0002
	7	0.0013	0.0024	0.0024	0.0025	0.0033	0.0025	0.0024	0.0024	0.0024	0.0027	0.0024	0.0005
	8	0.0024	0.0026	0.0024	0.0024	0.0027	0.0025	0.0023	0.0023	0.0024	0.0026	0.0025	0.0001
	9	0.0028	0.0026	0.0026	0.0025	0.0032	0.0031	0.0025	0.0025	0.0027	0.0029	0.0027	0.0002
	10	0.0024	0.0022	0.0022	0.0020	0.0000	0.0025	0.0020	0.0023	0.0022	0.0023	0.0020	0.0007
	11	0.0023	0.0021	0.0024	0.0022	0.0001	0.0030	0.0020	0.0031	0.0022	0.0027	0.0022	0.0008
	12	0.0017	0.0016	0.0021	0.0031		0.0024	0.0022	0.0006	0.0022	0.0038	0.0022	0.0009
	13	0.0028	0.0020	0.0020	0.0023	0.0001	0.0026	0.0025		0.0124	0.0019	0.0032	0.0034
	14	0.0015	0.0020				0.0041	0.0015		0.0056	0.0014	0.0027	0.0016
	15		0.0017		0.0003		0.0017	0.0015				0.0013	0.0006
	16		0.0019				0.0022					0.0021	0.0001
	17		0.0060				0.0034					0.0047	0.0013
	18		0.0097				0.0094					0.0095	0.0002
	Total	0.0224	0.0419	0.0209	0.0226	0.0158	0.0438	0.0240	0.0183	0.0367	0.0256	0.0272	0.0094
I	4	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0036	0.0035	0.0030	0.0035	0.0044	0.0030	0.0034	0.0034	0.0031	0.0036	0.0034	0.0004
	6	0.0063	0.0059	0.0056	0.0061	0.0074	0.0057	0.0058	0.0029	0.0058	0.0054	0.0057	0.0011
	7	0.0079	0.0076	0.0075	0.0079	0.0088	0.0076	0.0075	0.0077	0.0076	0.0081	0.0078	0.0004
	8	0.0104	0.0101	0.0106	0.0092	0.0101	0.0107	0.0102	0.0082	0.0113	0.0111	0.0102	0.0009
	9	0.0109	0.0112	0.0117	0.0103	0.0014	0.0102	0.0100	0.0106	0.0136	0.0119	0.0102	0.0031
	10	0.0069	0.0112	0.0119	0.0077	0.0000	0.0091	0.0103	0.0140	0.0139	0.0095	0.0094	0.0039
	11	0.0060	0.0086	0.0075	0.0056		0.0073	0.0055	0.0061	0.0079	0.0040	0.0065	0.0014
	12	0.0031	0.0097	0.0134	0.0055		0.0049	0.0017	0.0144	0.0087	0.0037	0.0072	0.0043
	13	0.0076	0.0018	0.0009	0.0021		0.0077	0.0023	0.0036		0.0014	0.0034	0.0025
	14		0.0094									0.0094	0.0000
	15		0.0012									0.0012	0.0000
	16		0.0005									0.0005	0.0000
	17		0.0012									0.0012	0.0000
	18		0.0010									0.0010	0.0000
	Total	0.0626	0.0830	0.0722	0.0578	0.0322	0.0661	0.0566	0.0710	0.0720	0.0587	0.0632	0.0129

PIONA Group	Carbon No.	Lab A	Lab B	Lab C	Lab D	Lab E	Lab F	Lab G	Lab H	Lab I	Lab J	Mean	Std. Dev.
O	2												
	3			0.0000	0.0000							0.0000	0.0000
	4	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	5	0.0024	0.0024	0.0023	0.0021	0.0027	0.0019	0.0022	0.0026	0.0026	0.0068	0.0028	0.0014
	6	0.0031	0.0043	0.0036	0.0030	0.0030	0.0028	0.0031	0.0087	0.0026	0.0045	0.0039	0.0017
	7	0.0029	0.0045	0.0046	0.0035	0.0000	0.0035	0.0030	0.0048	0.0050	0.0059	0.0038	0.0016
	8	0.0010	0.0024	0.0009	0.0047	0.0000	0.0016	0.0022	0.0060	0.0004		0.0021	0.0019
	9	0.0012	0.0040	0.0021	0.0012		0.0022	0.0017	0.0022	0.0008	0.0020	0.0020	0.0009
	10	0.0008		0.0007	0.0012	0.0000	0.0042	0.0019	0.0005	0.0006	0.0005	0.0012	0.0012
	11		0.0009	0.0008		0.0000		0.0006	0.0012			0.0007	0.0004
	12		0.0031	0.0009	0.0003		0.0005		0.0014		0.0011	0.0012	0.0009
	13			0.0015					0.0041		0.0052	0.0036	0.0015
	Total	0.0114	0.0215	0.0175	0.0160	0.0057	0.0167	0.0147	0.0316	0.0121	0.0260	0.0173	0.0071
N	5	0.0007	0.0005	0.0005	0.0007	0.0009	0.0006	0.0007	0.0005	0.0005	0.0005	0.0006	0.0001
	6	0.0057	0.0045	0.0043	0.0059	0.0068	0.0054	0.0057	0.0046	0.0044	0.0048	0.0052	0.0008
	7	0.0150	0.0085	0.0094	0.0101	0.0091	0.0110	0.0119	0.0096	0.0085	0.0092	0.0102	0.0019
	8	0.0152	0.0110	0.0132	0.0118	0.0000	0.0150	0.0147	0.0149	0.0127	0.0151	0.0124	0.0044
	9	0.0117	0.0131	0.0125	0.0098	0.0000	0.0125	0.0138	0.0127	0.0108	0.0102	0.0107	0.0038
	10	0.0577	0.0068	0.0064	0.0054		0.0065	0.0020	0.0055	0.0022	0.0085	0.0112	0.0166
	11	0.0226	0.0072	0.0015	0.0026		0.0001	0.0008	0.0015	0.0004		0.0046	0.0071
	12	0.0003	0.0034	0.0003					0.0032	0.0007	0.0035	0.0019	0.0015
	13				0.0007		0.0018	0.0013				0.0012	0.0005
	Total	0.1288	0.0550	0.0480	0.0469	0.0168	0.0531	0.0509	0.0525	0.0401	0.0517	0.0544	0.0270
A	6	0.0103	0.0097	0.0095	0.0103	0.0122	0.0088	0.0097	0.0093	0.0108	0.0104	0.0101	0.0009
	7	0.0661	0.0632	0.0628	0.0662	0.0802	0.0628	0.0633	0.0601	0.0628	0.0671	0.0655	0.0053
	8	0.1756	0.1717	0.1628	0.1741	0.2154	0.1859	0.1650	0.1497	0.1536	0.1717	0.1726	0.0175
	9	0.3048	0.2804	0.2692	0.2815	0.3556	0.3366	0.2704	0.2501	0.2688	0.2921	0.2910	0.0312
	10	0.5533	0.4070	0.4917	0.4108	0.1987	0.5027	0.4143	0.3719	0.2287	0.4939	0.4073	0.1104
	11	0.2015	0.4335	0.3757	0.5069	0.1020	0.6963	0.5670	0.0944	0.1409	0.4890	0.3607	0.2025
	12	0.5668	0.3751	0.1419	0.3703	0.0009	0.4213	0.3807	0.1293	0.1581	0.0999	0.2644	0.1715
	13		0.0545		0.0224		0.0510	0.0473				0.0438	0.0126
	14		0.0304		0.0025		0.0311					0.0213	0.0134
	15												
	Total	1.8785	1.8256	1.5134	1.8450	0.9650	2.2964	1.9177	1.0649	1.0238	1.6242	1.5954	0.4247
X	2	0.0111	0.0139	0.0138	0.0137	0.0123	0.0143	0.0132	0.0127	0.0134		0.0131	0.0009
	3												
	4												
	5								0.0001			0.0001	0.0000
	6		0.0001									0.0001	0.0000
	Total	0.0111	0.0140	0.0138	0.0137	0.0123	0.0143	0.0132	0.0128	0.0134		0.0132	0.0009
U*	0	0.0225	0.0035	0.4467	0.1271		0.1318	0.1404	0.3143	0.5467	0.1917	0.2139	0.1751
	15+							0.1566				0.1566	0.0000
	Total	0.0225	0.0035	0.4467	0.1271	0.0000	0.1318	0.2969	0.3143	0.5467	0.1917	0.2081	0.1797
Grand Total		2.1373	2.0445	2.1324	2.1292	1.0477	2.6222	2.3741	1.5653	1.7447	1.9779	1.9776	0.4170

* "0" indicates unknowns of all carbon numbers; "15+" indicates sum of all unknowns having 15+ carbon number (for Lab G only)

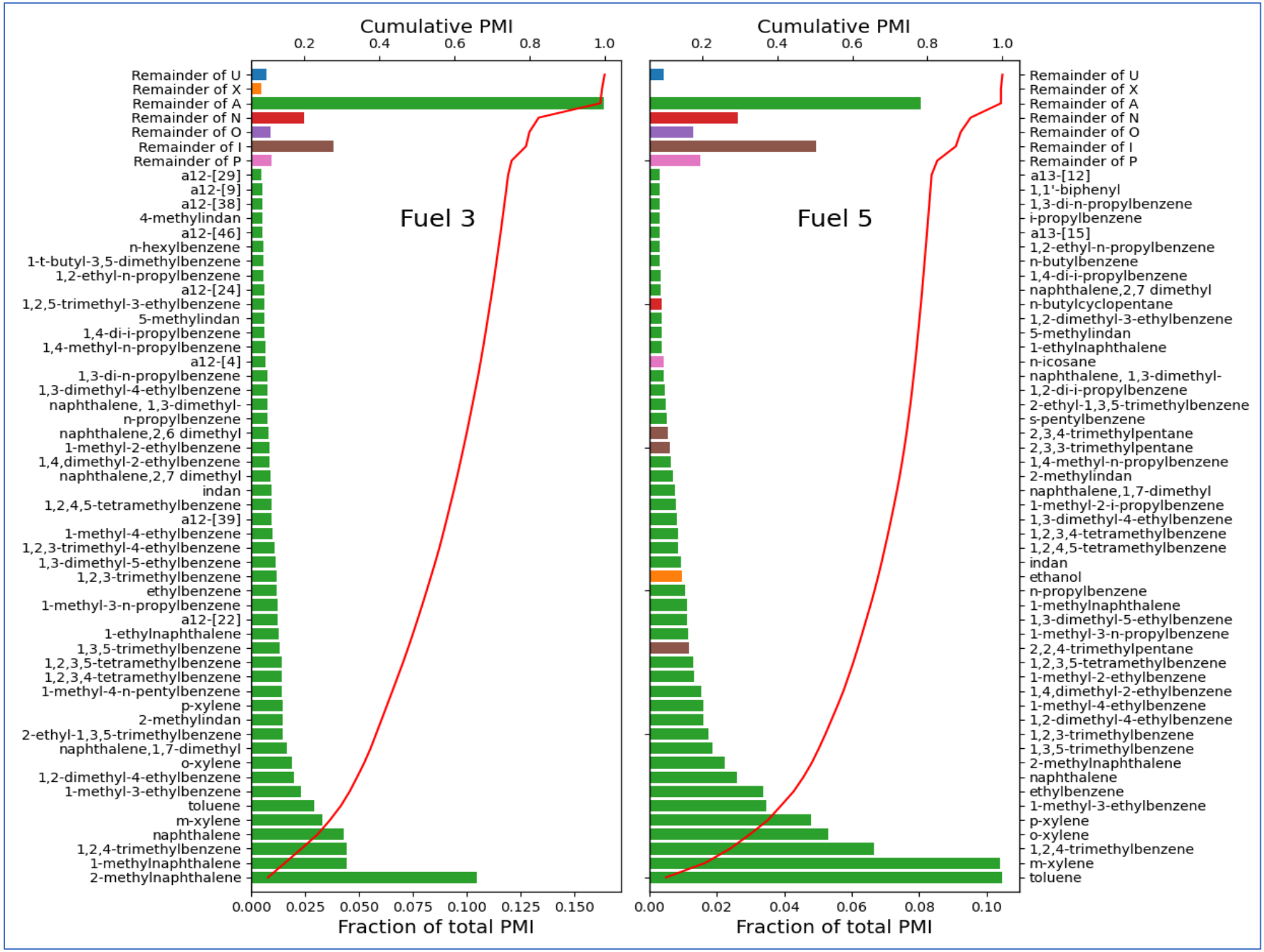
Appendix IX-1

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab A



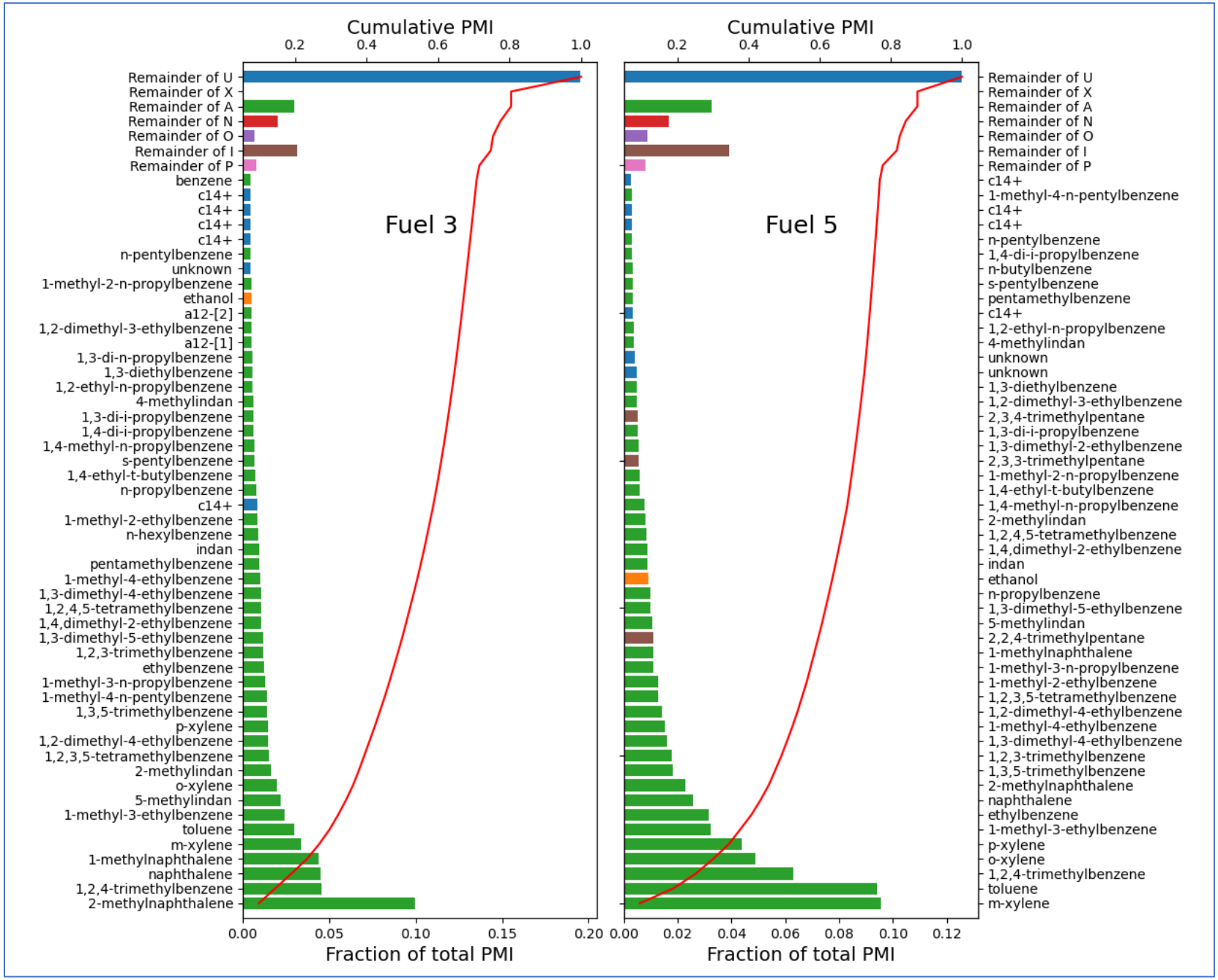
Appendix IX-2

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab B



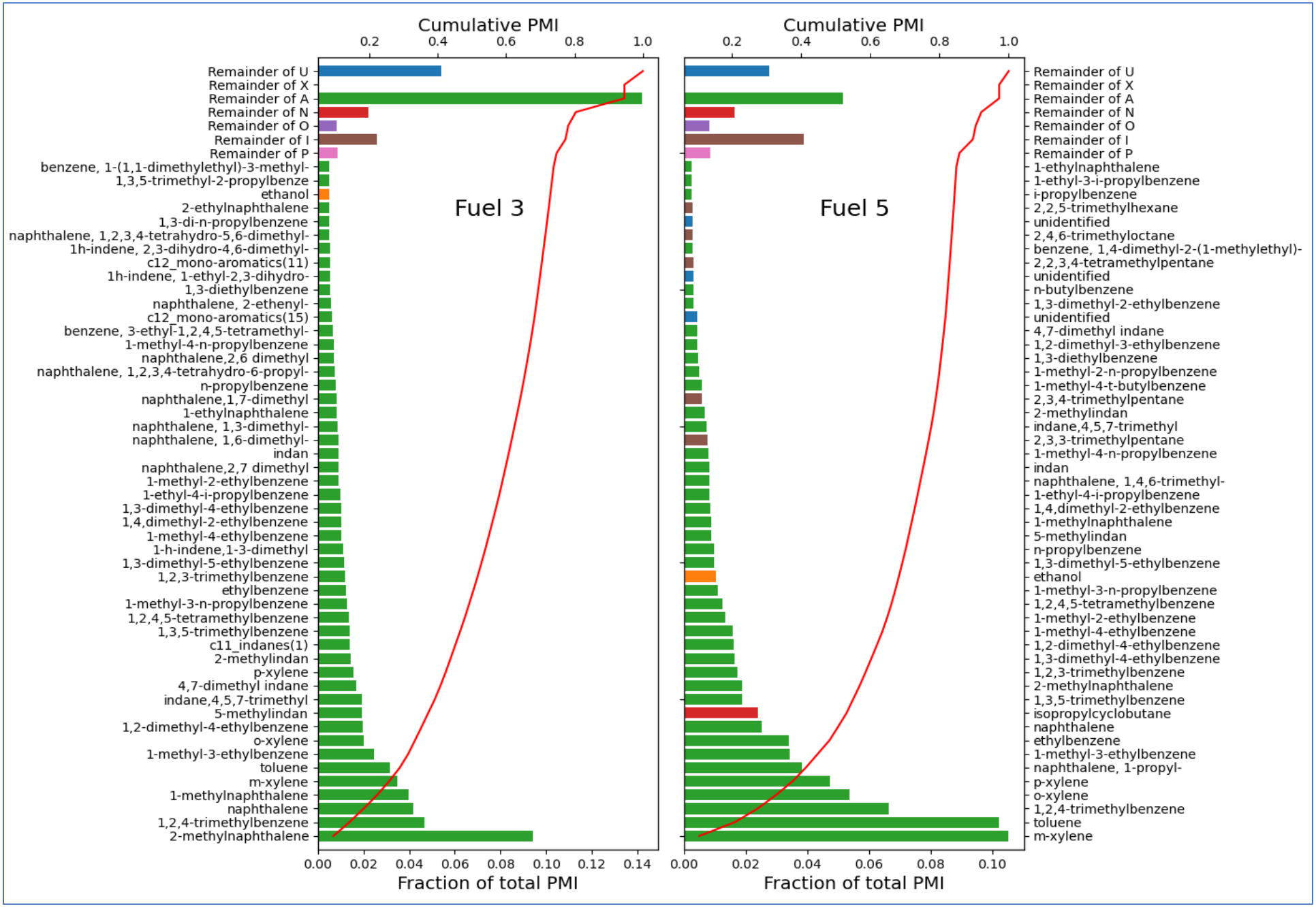
Appendix IX-3

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab C



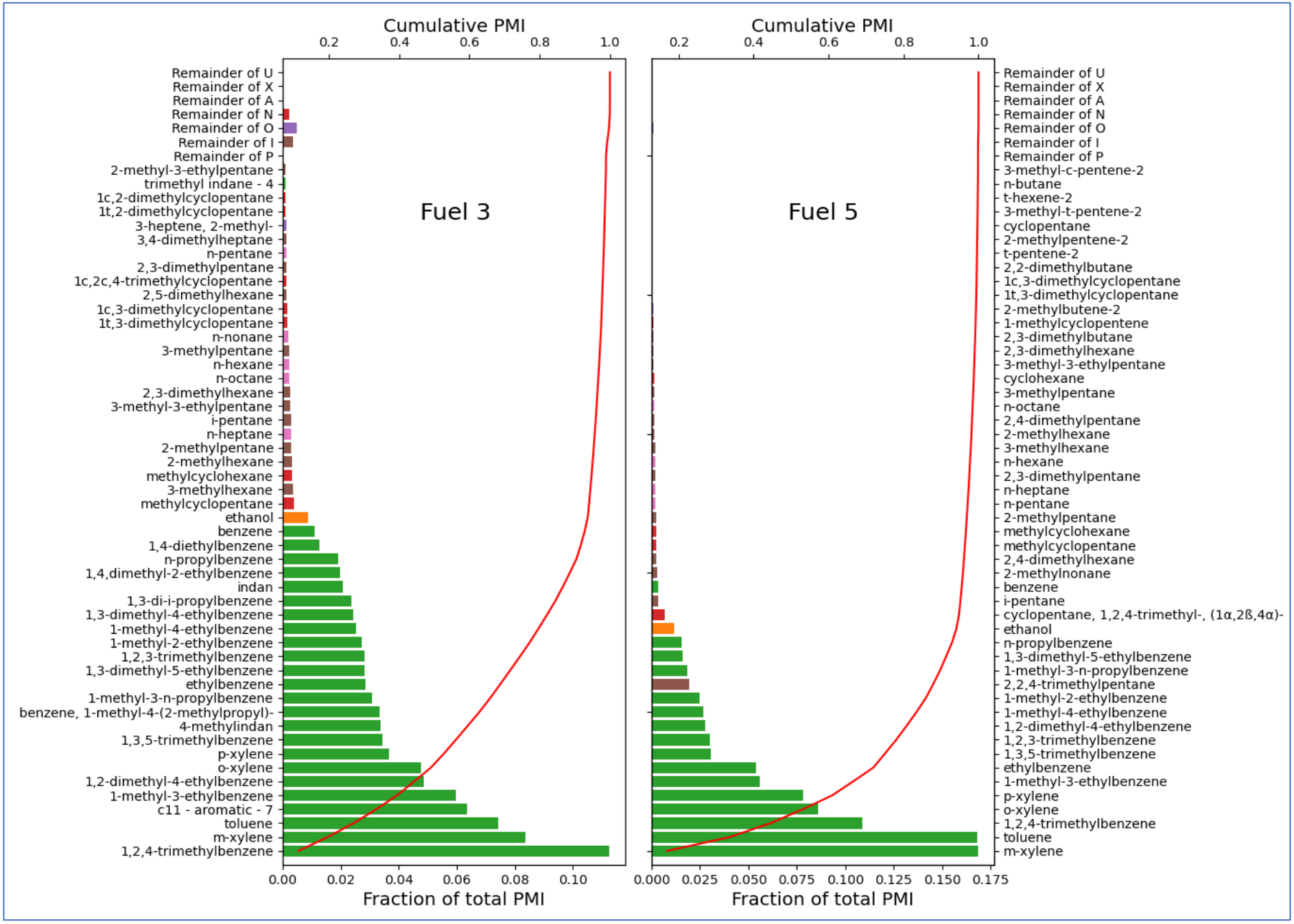
Appendix IX-4

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab D



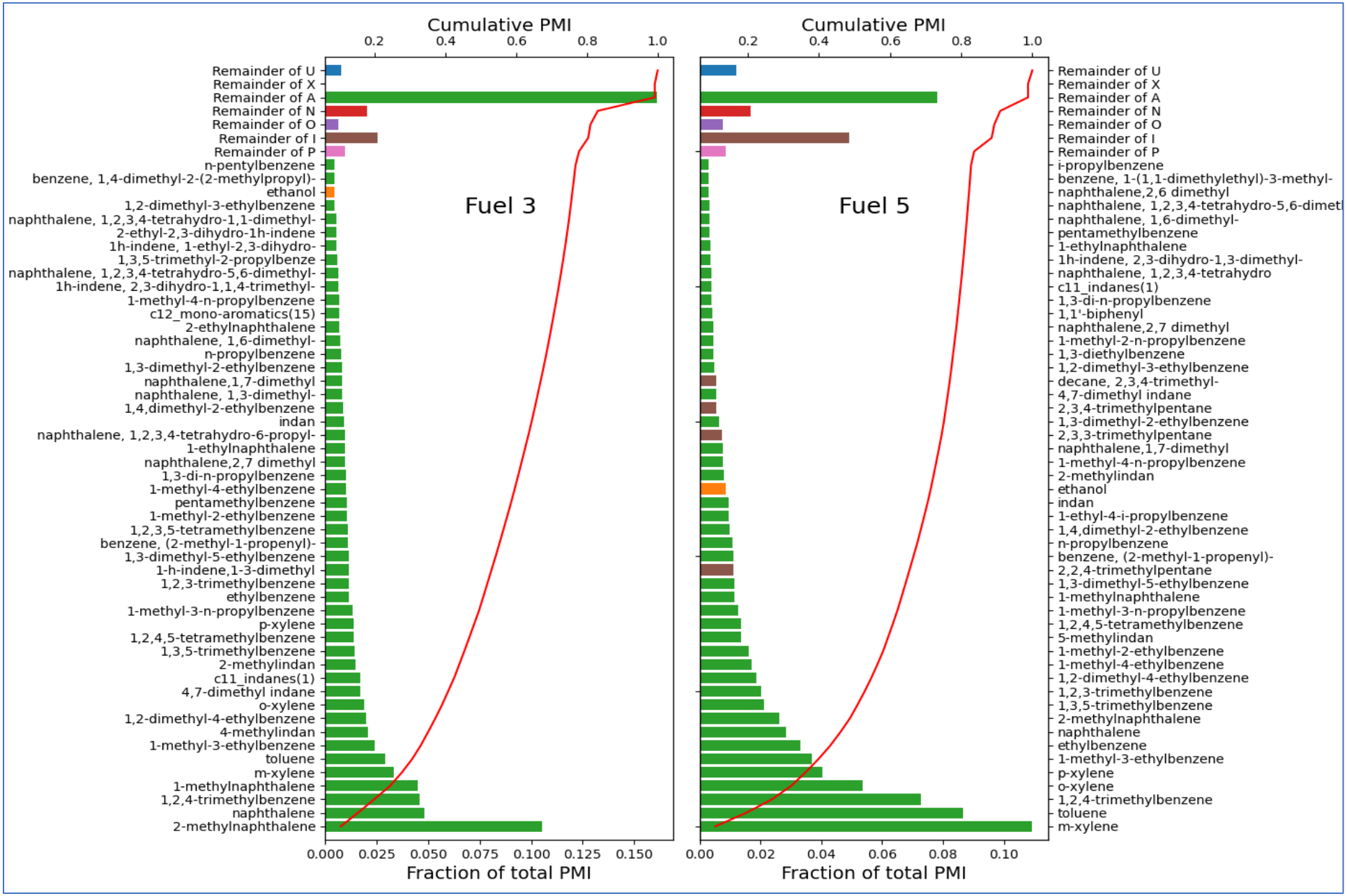
Appendix IX-5

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab E



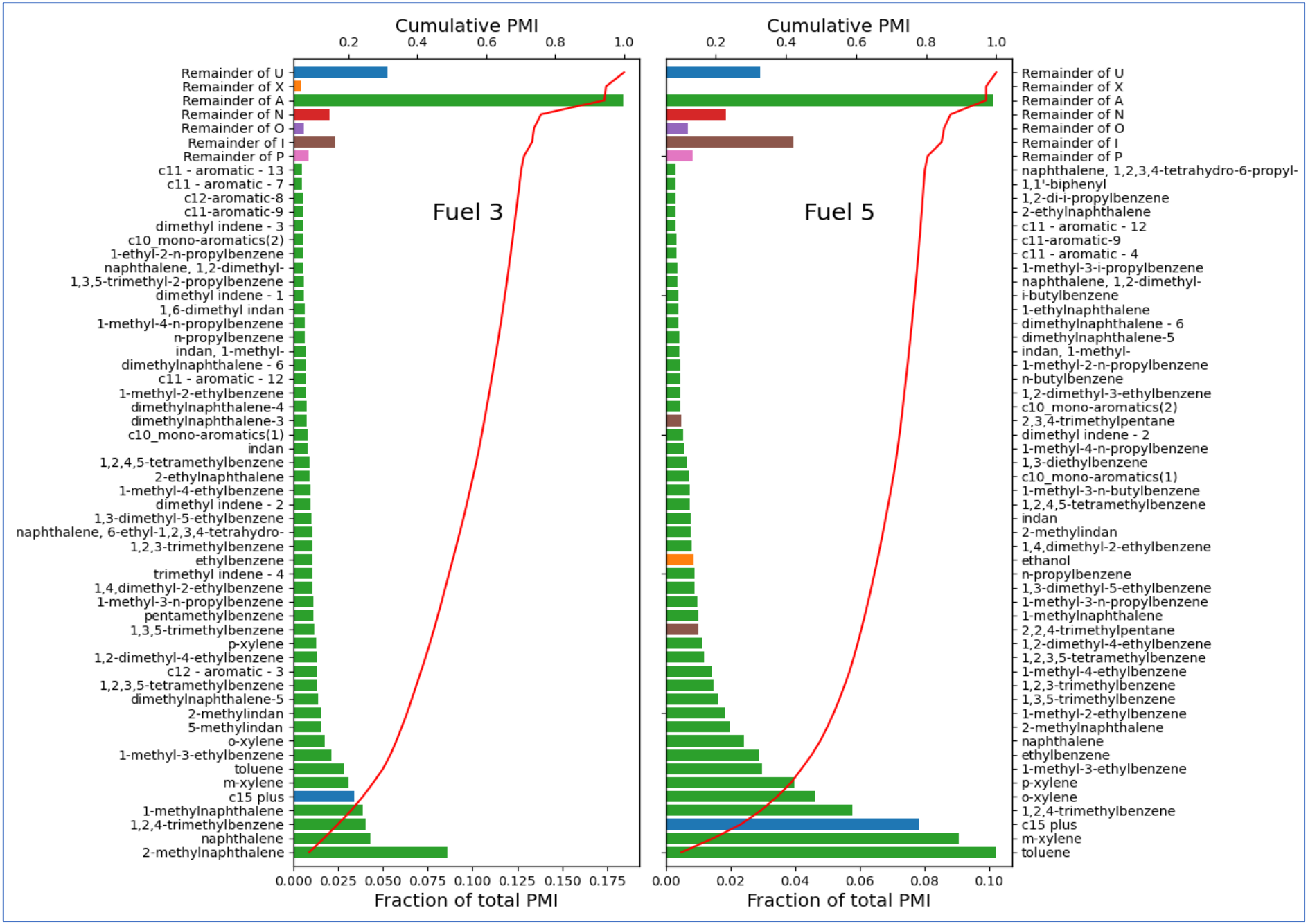
Appendix IX-6

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab F



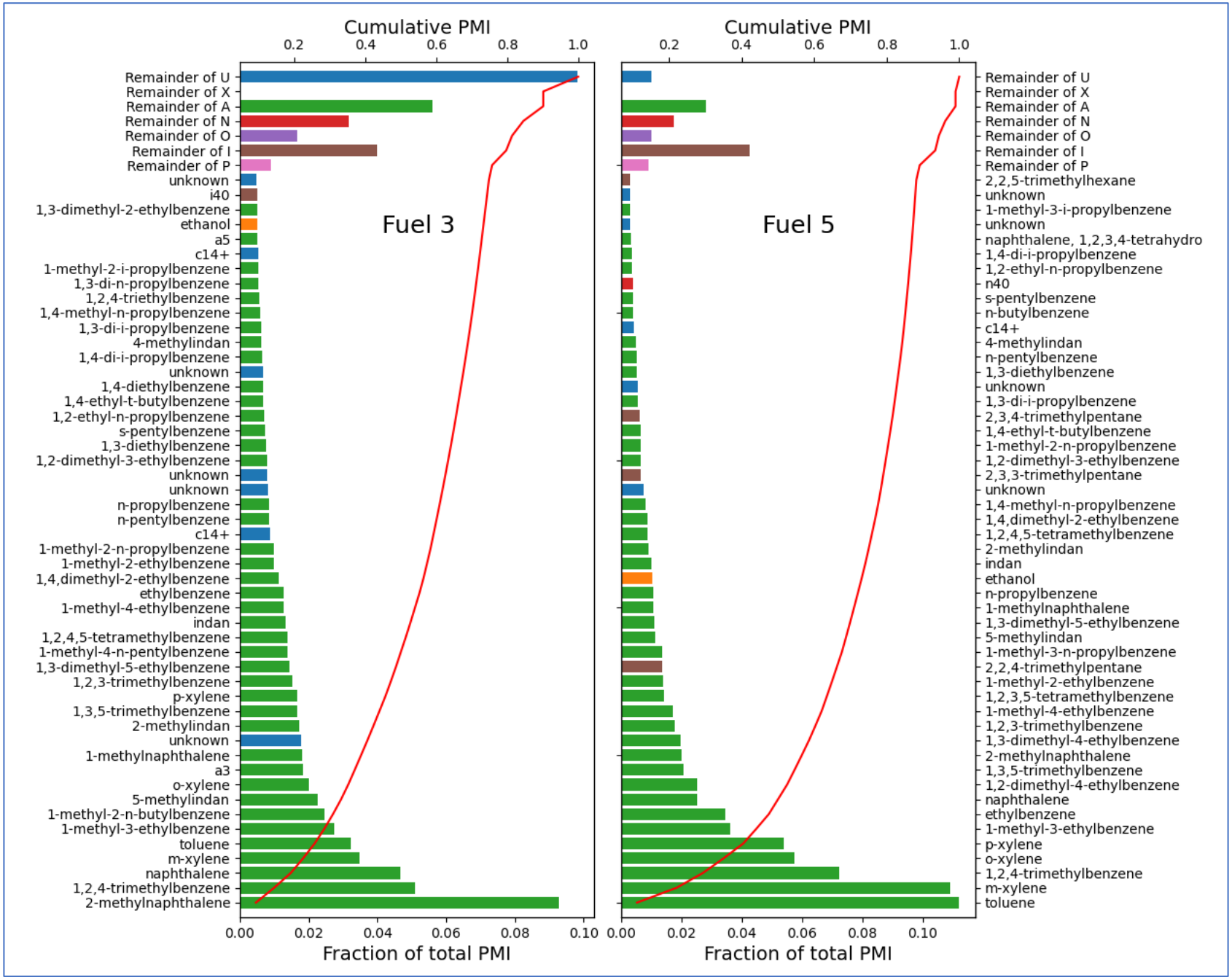
Appendix IX-7

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab G



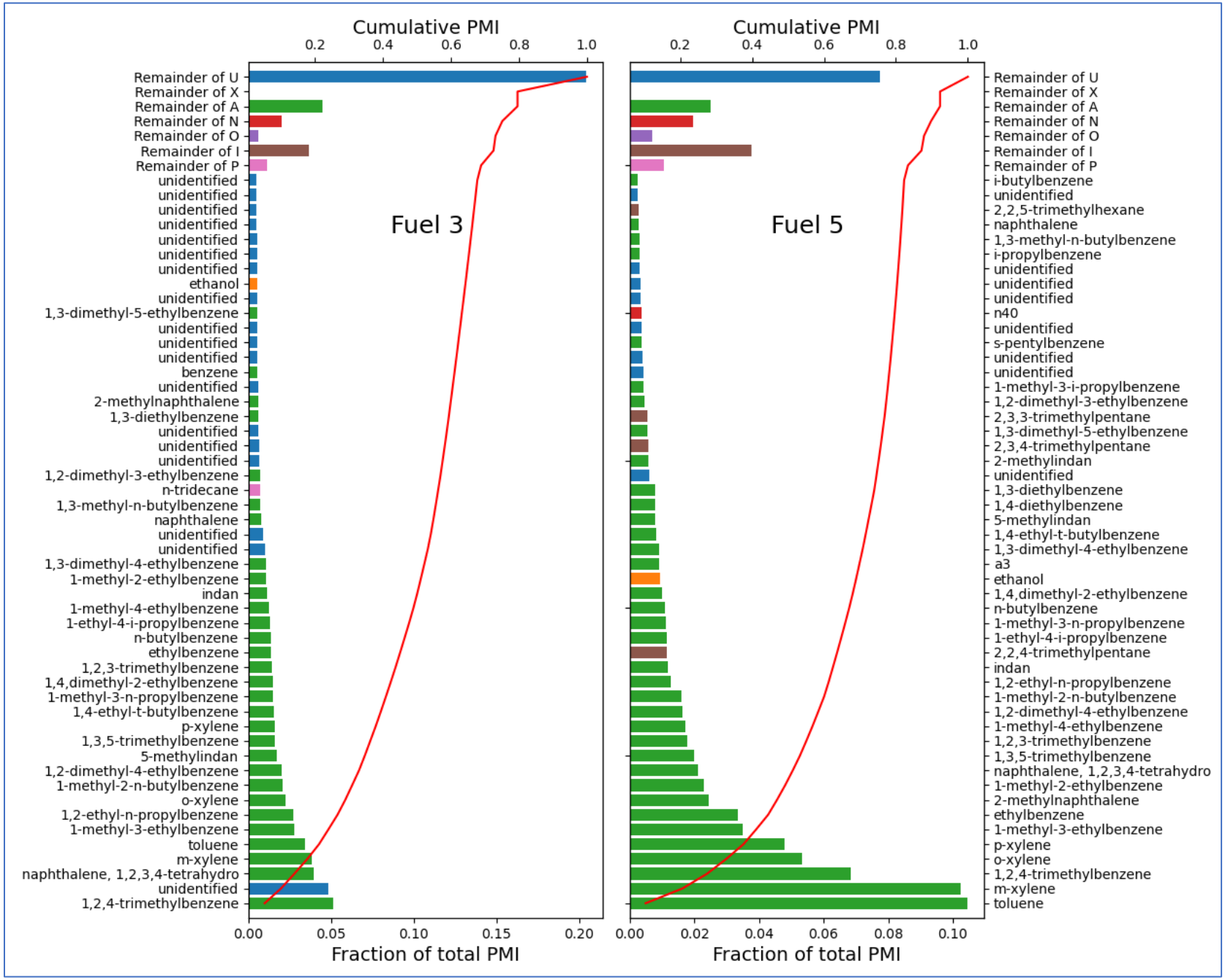
Appendix IX-8

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab H



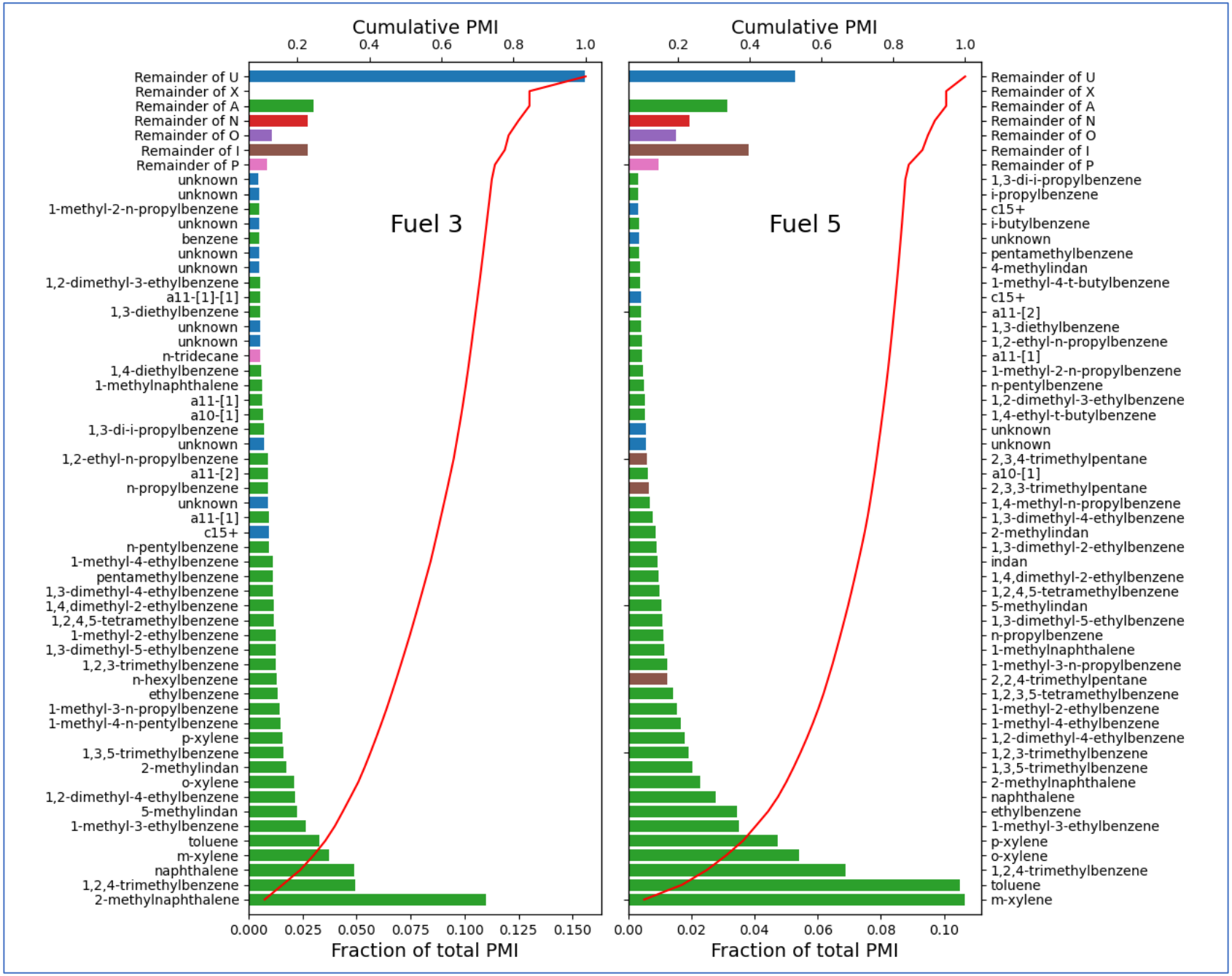
Appendix IX-9

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab I



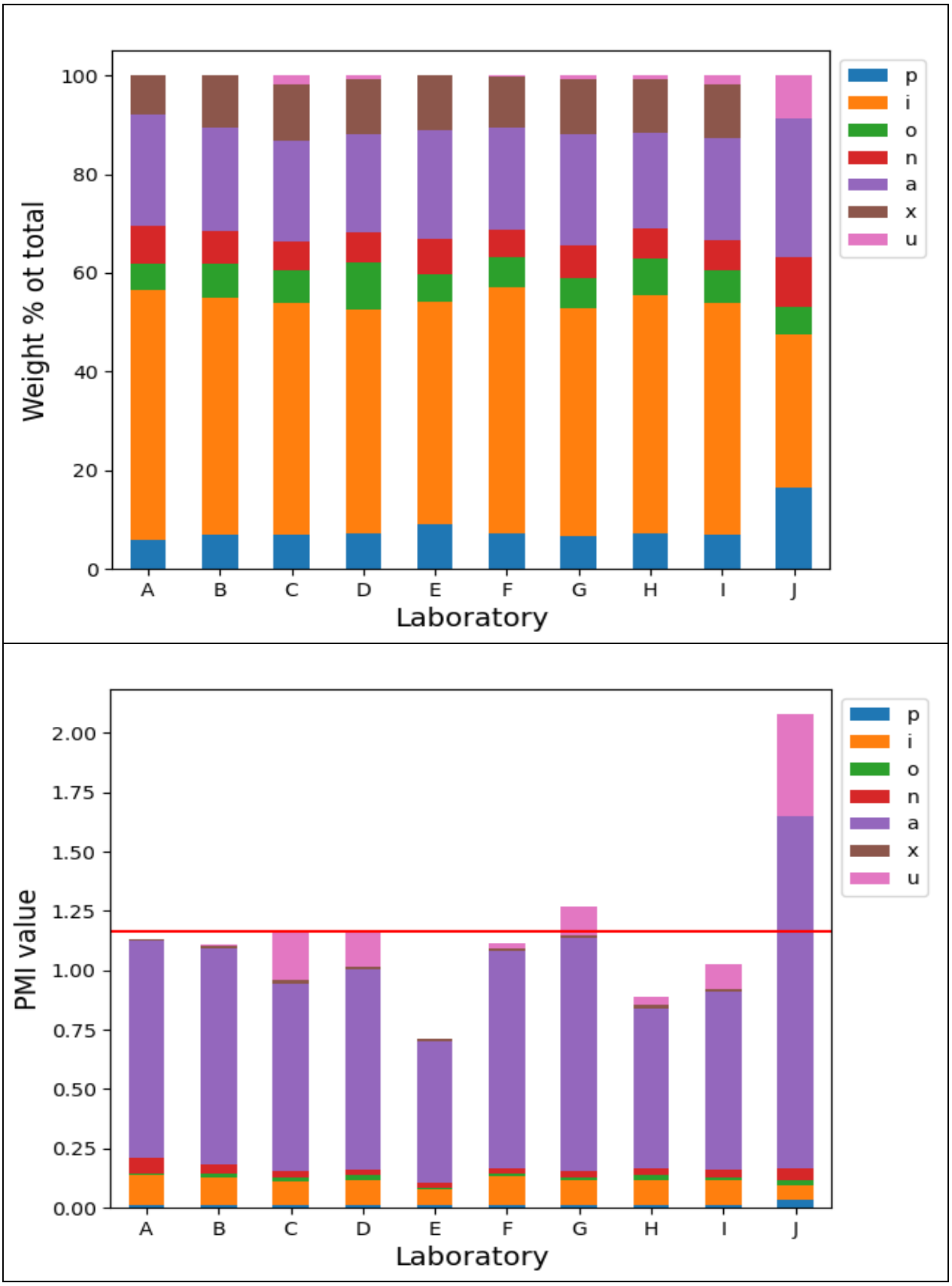
Appendix IX-10

Top 50 individual contributors to total PMI of Fuel 3 and Fuel 5, as determined by Lab J



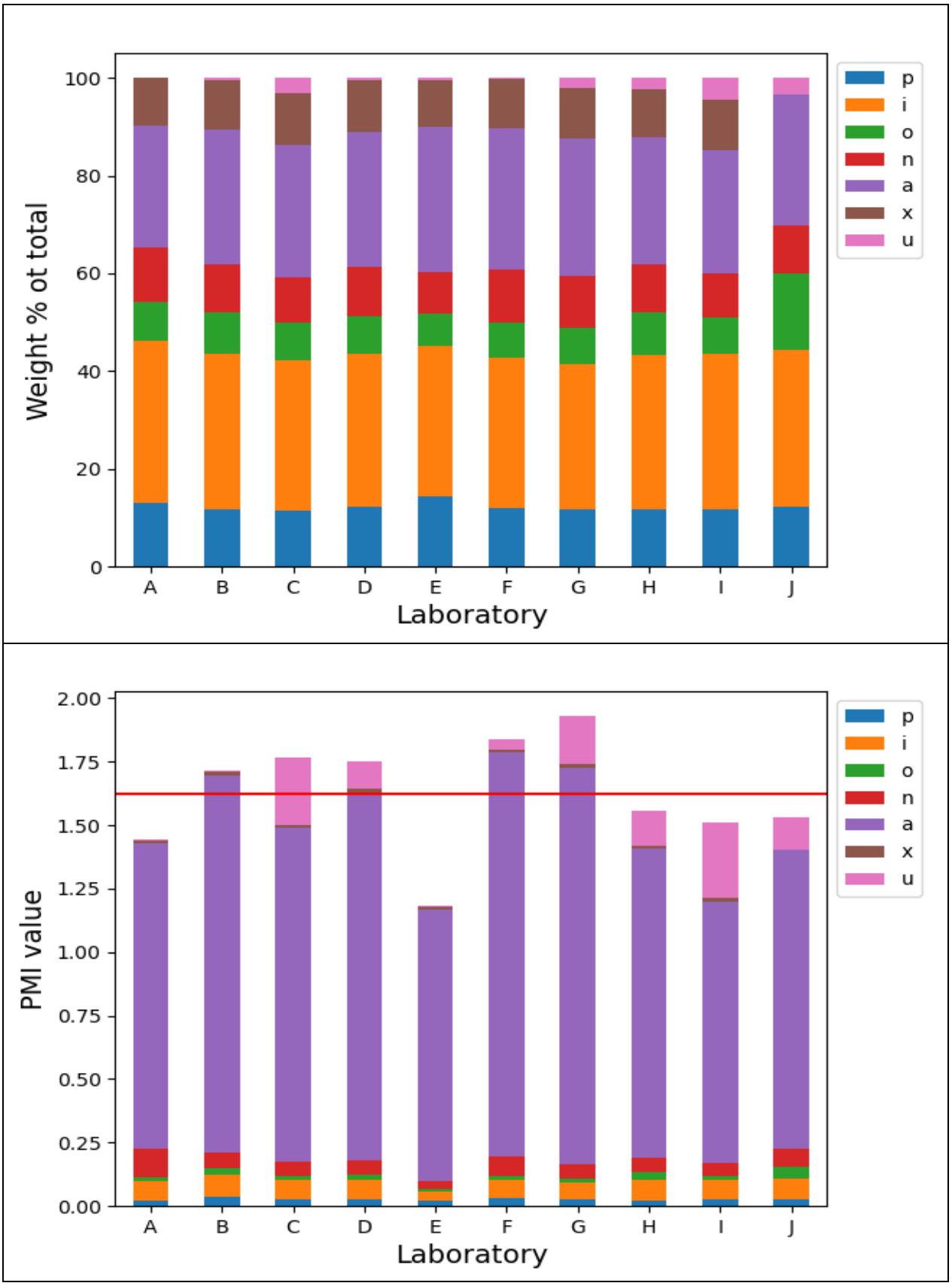
Appendix V-1

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 1



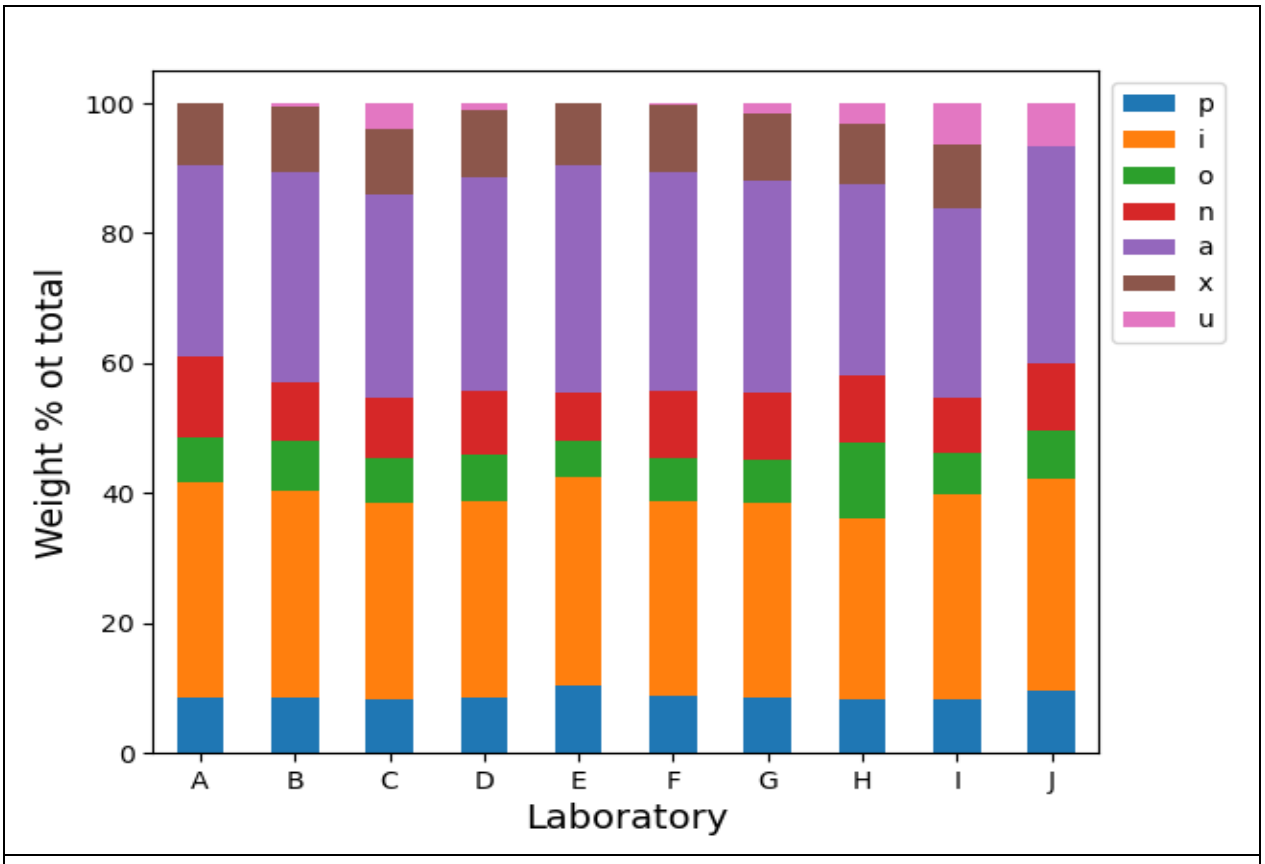
Appendix V-2

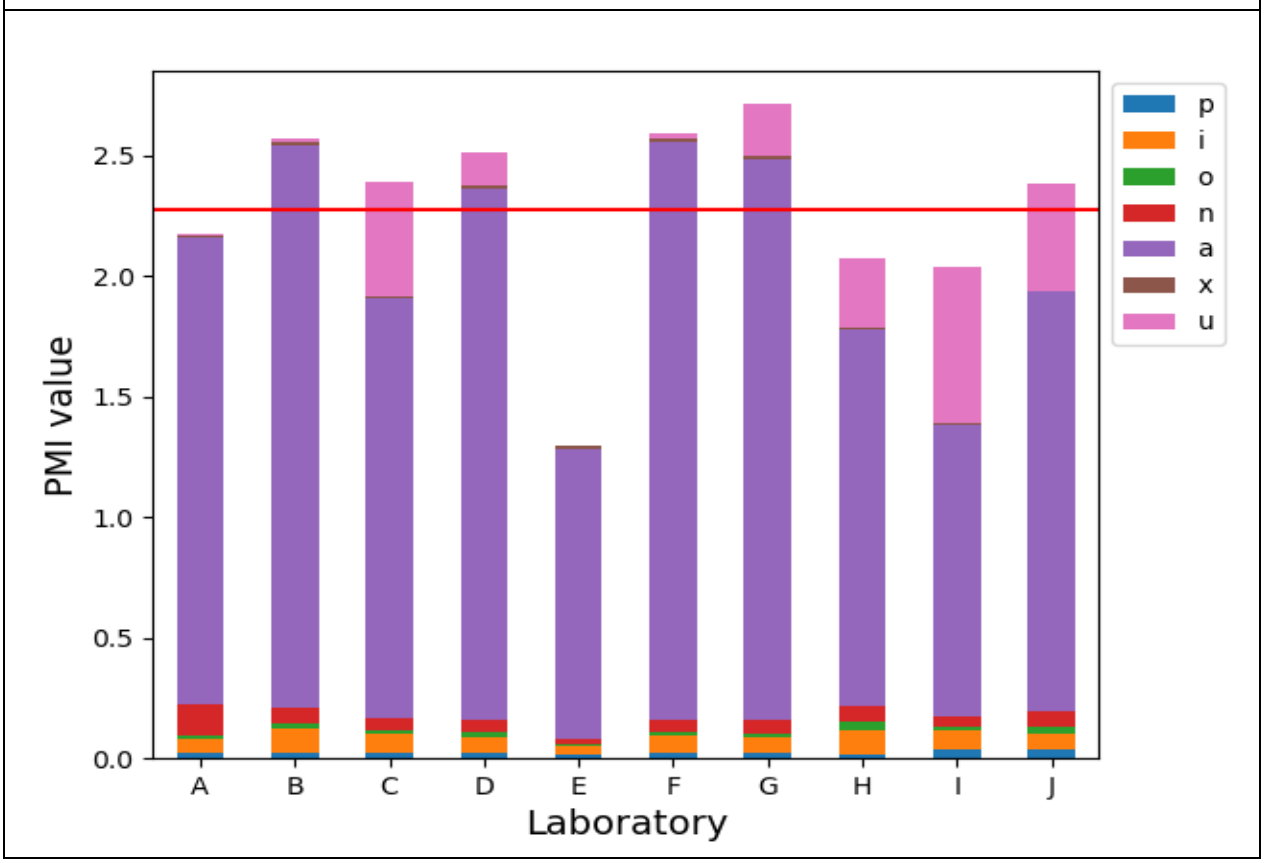
Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 2



Appendix V-3

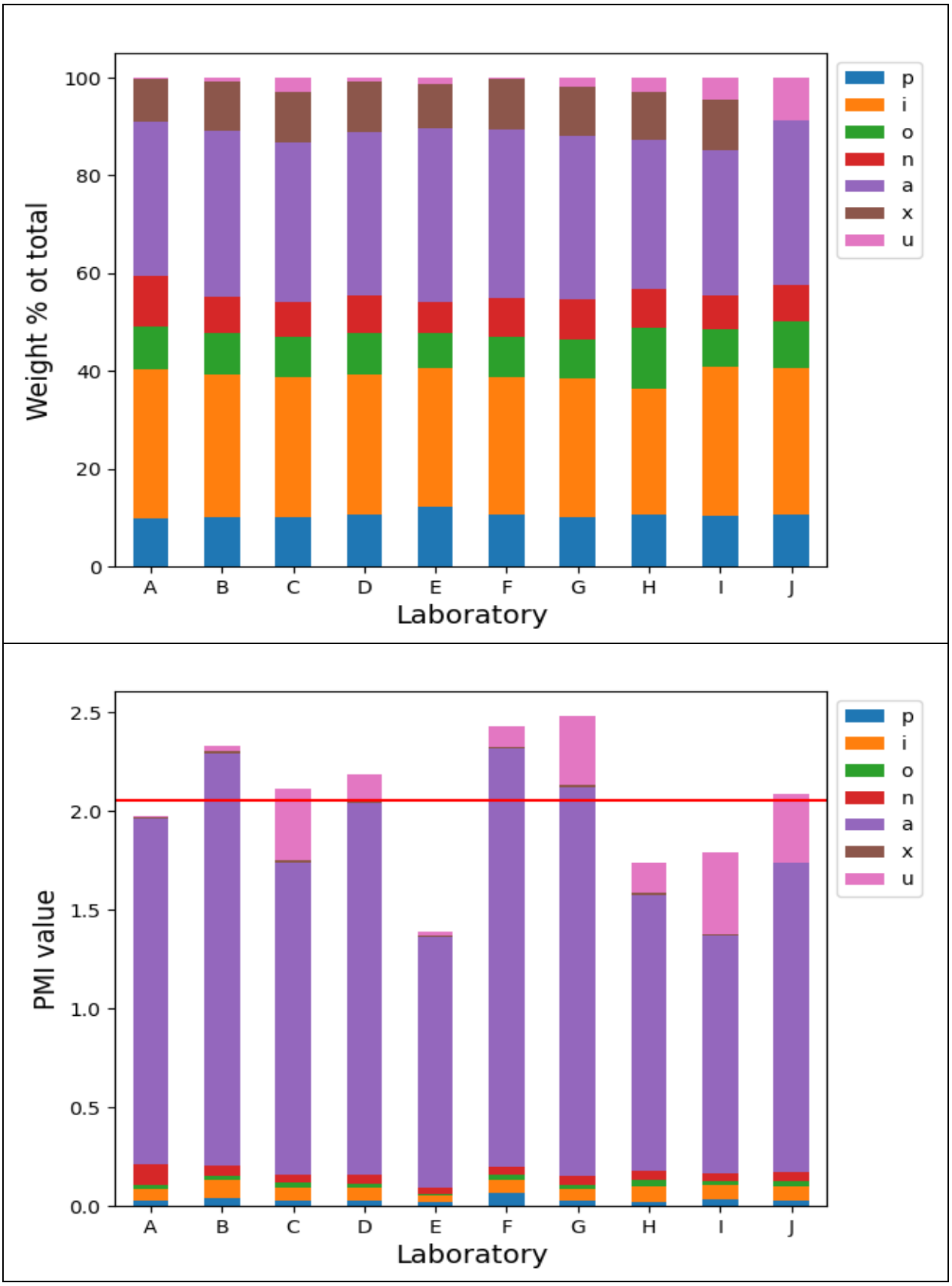
Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 3





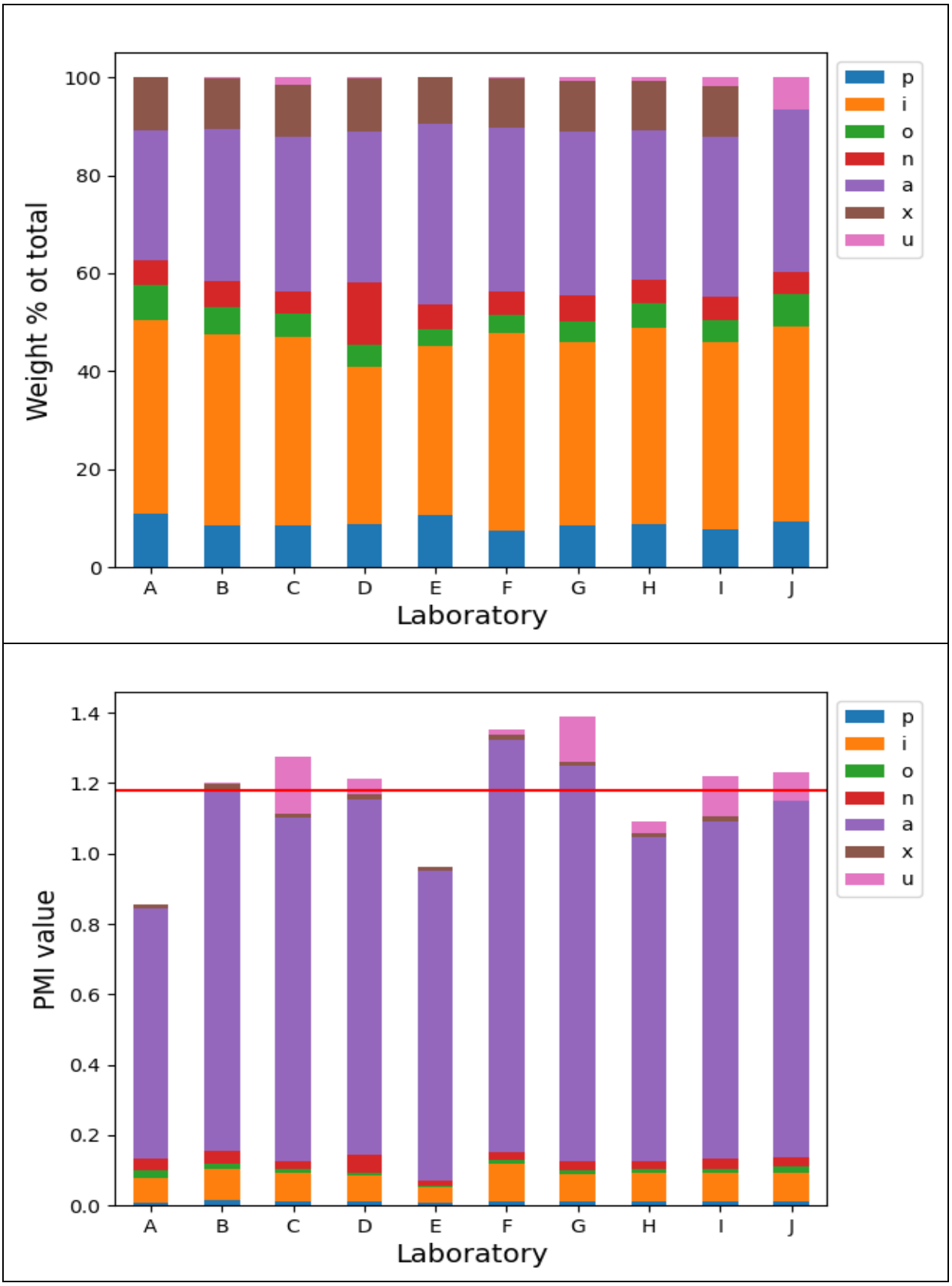
Appendix V-4

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 4



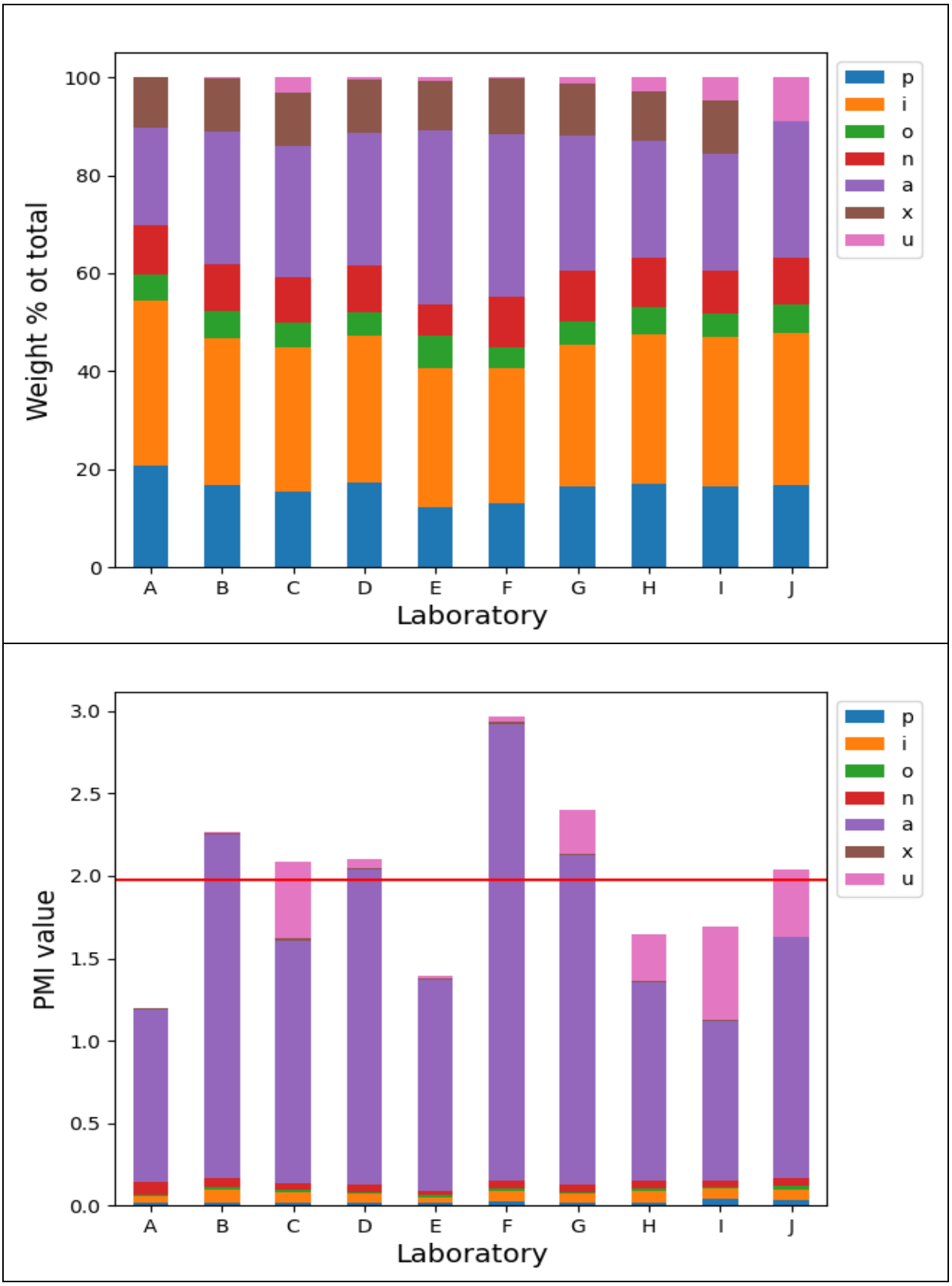
Appendix V-5

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 5



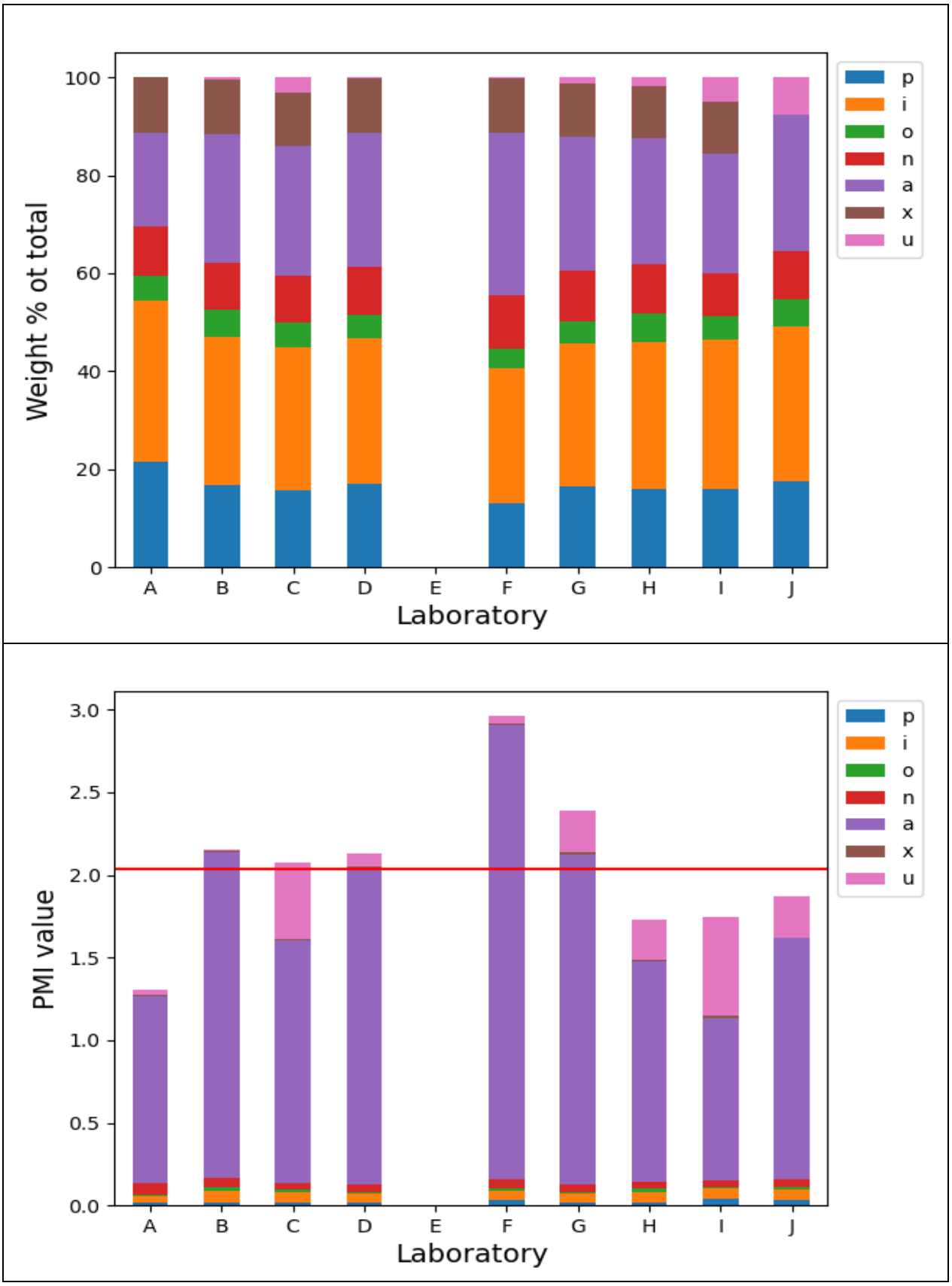
Appendix V-6

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 6a



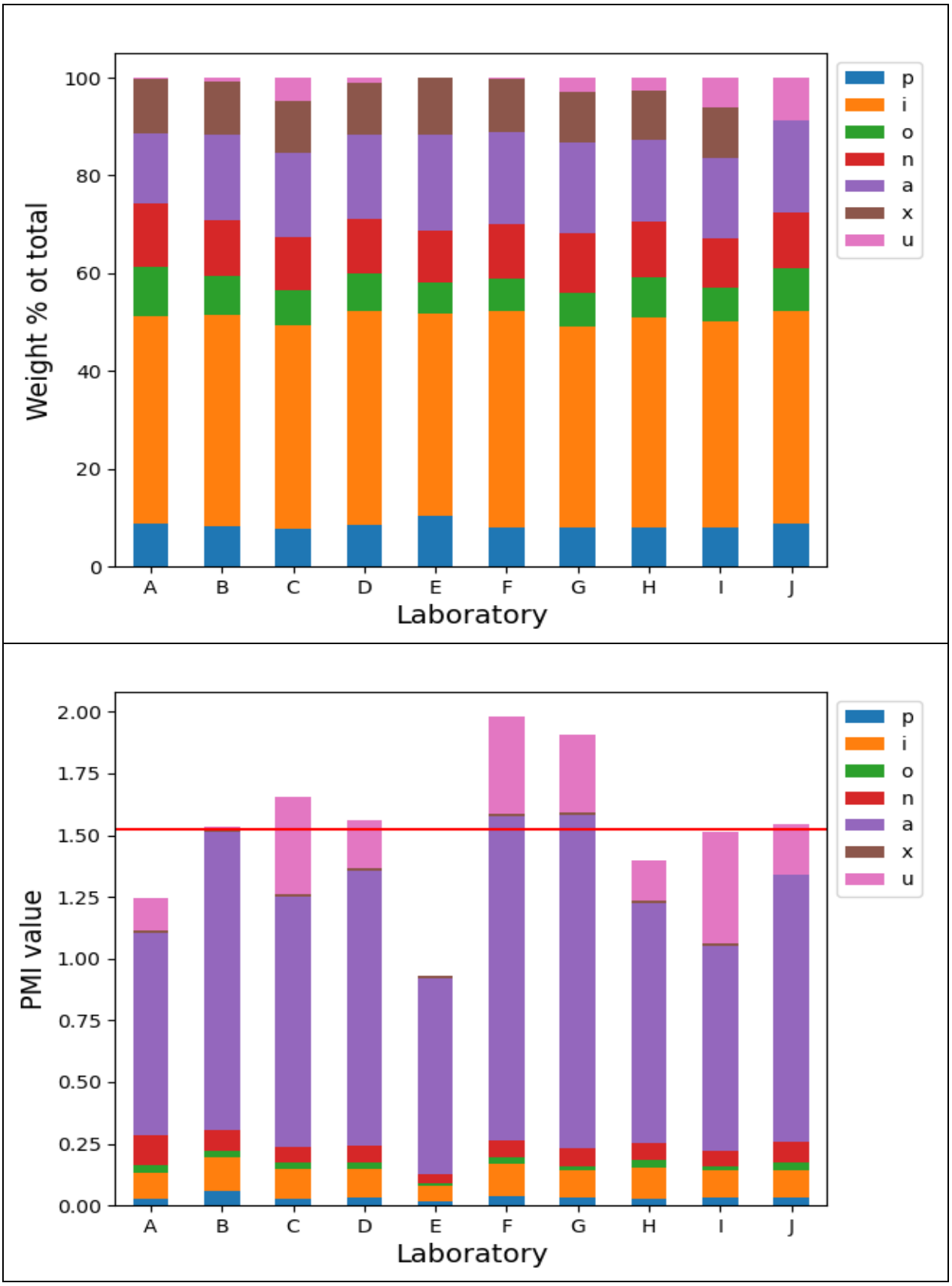
Appendix V-7

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 6b



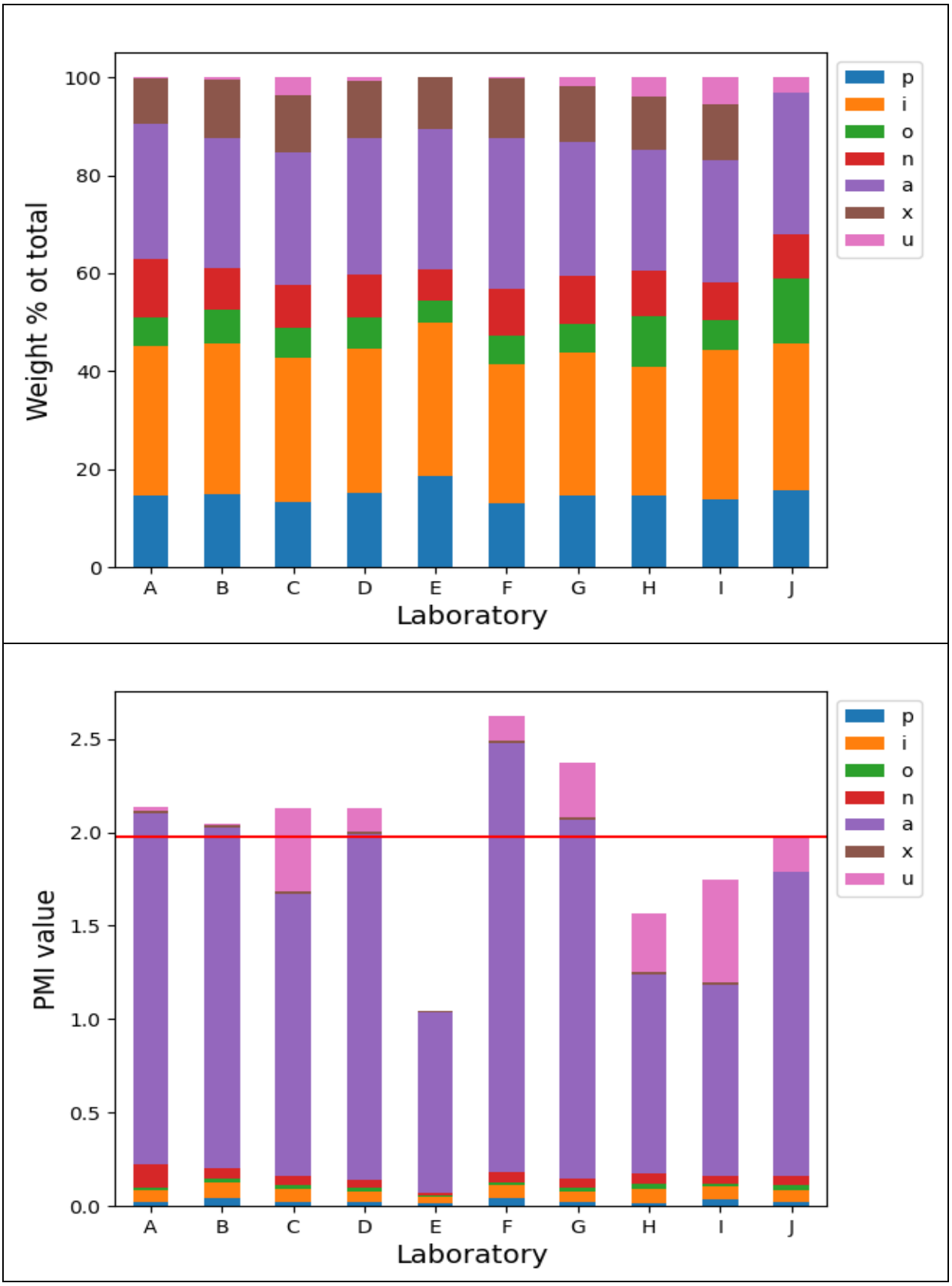
Appendix V-8

Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 7



Appendix V-9

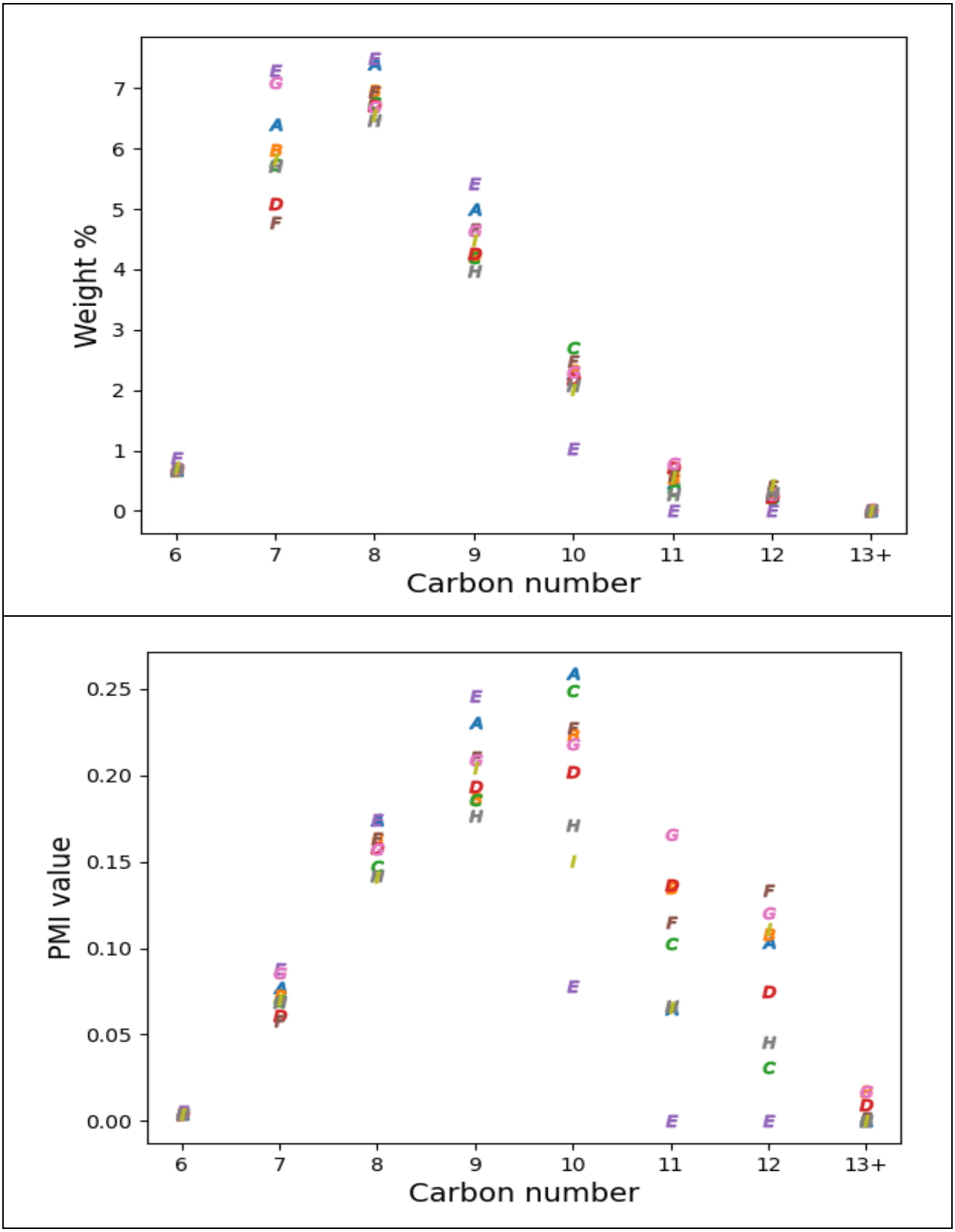
Summary of Wt.% and PMI Contributions by PIONA Group from DHA of Fuel 8



Appendix VI-1

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 1

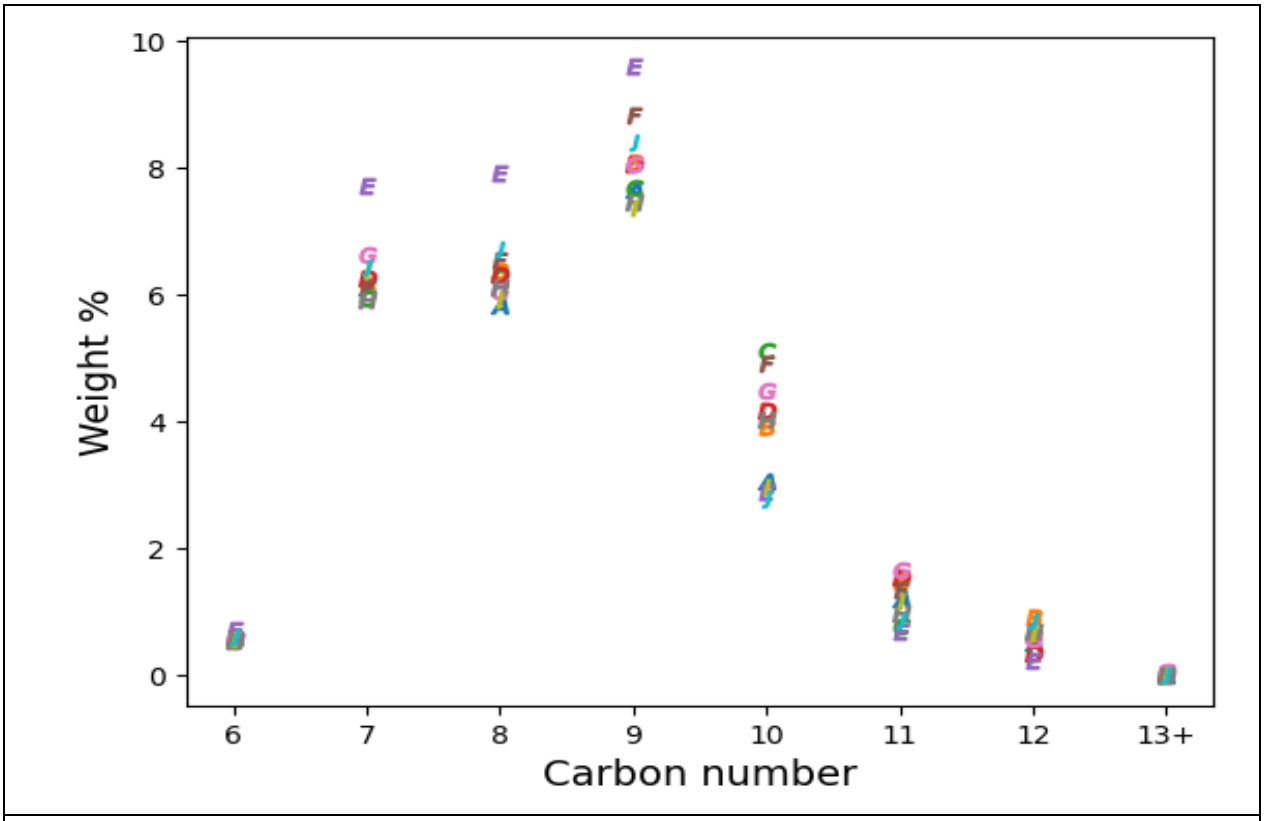
(Letter symbols indicate Lab identity. Lab J was excluded from Fuel 1)

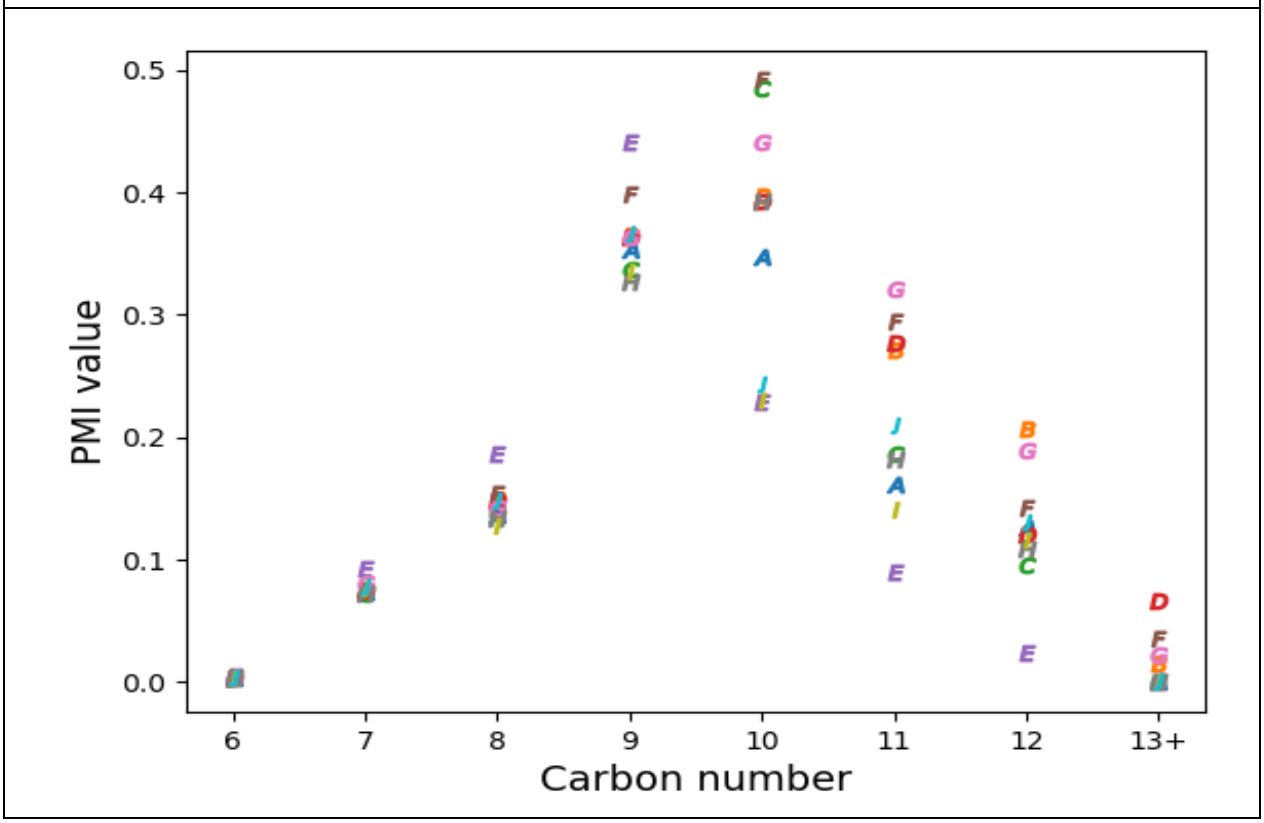


Appendix VI-2

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 2

(Letter symbols indicate Lab identity)

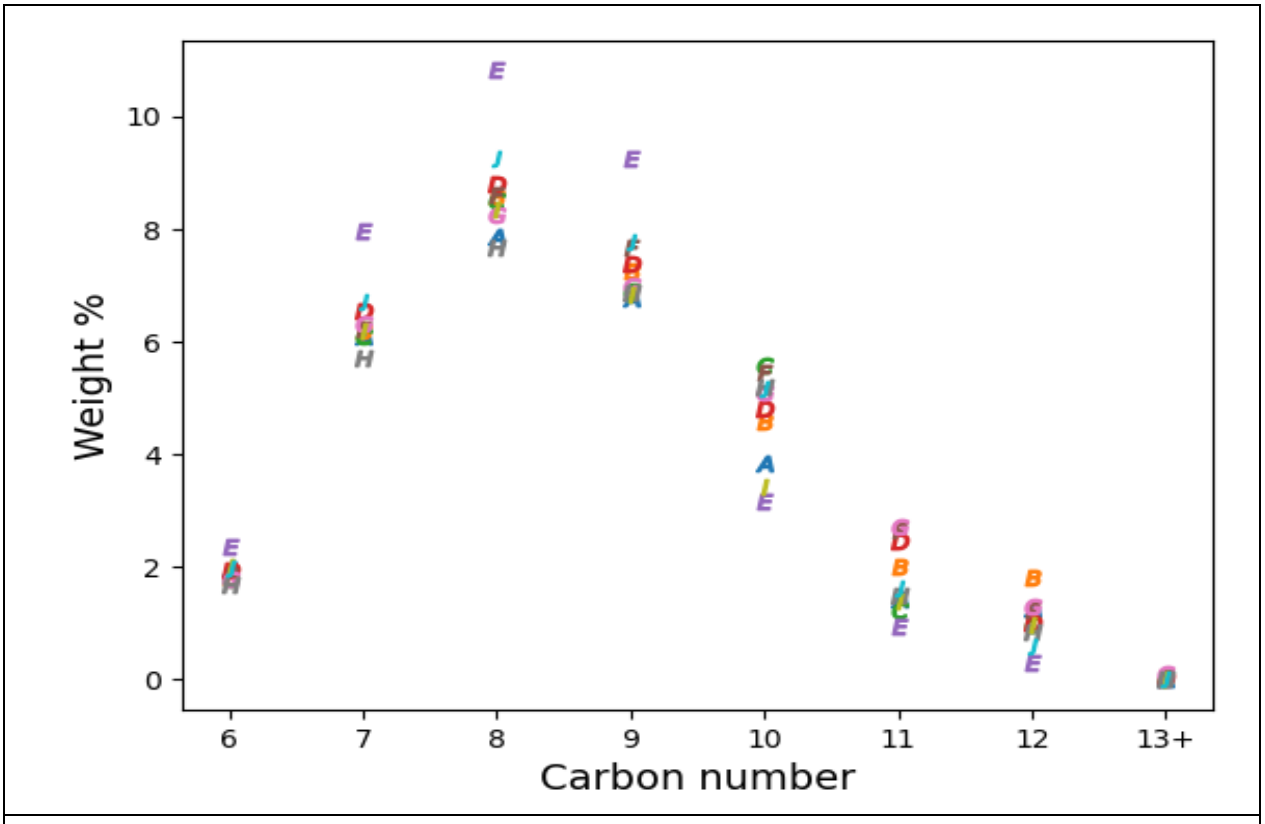


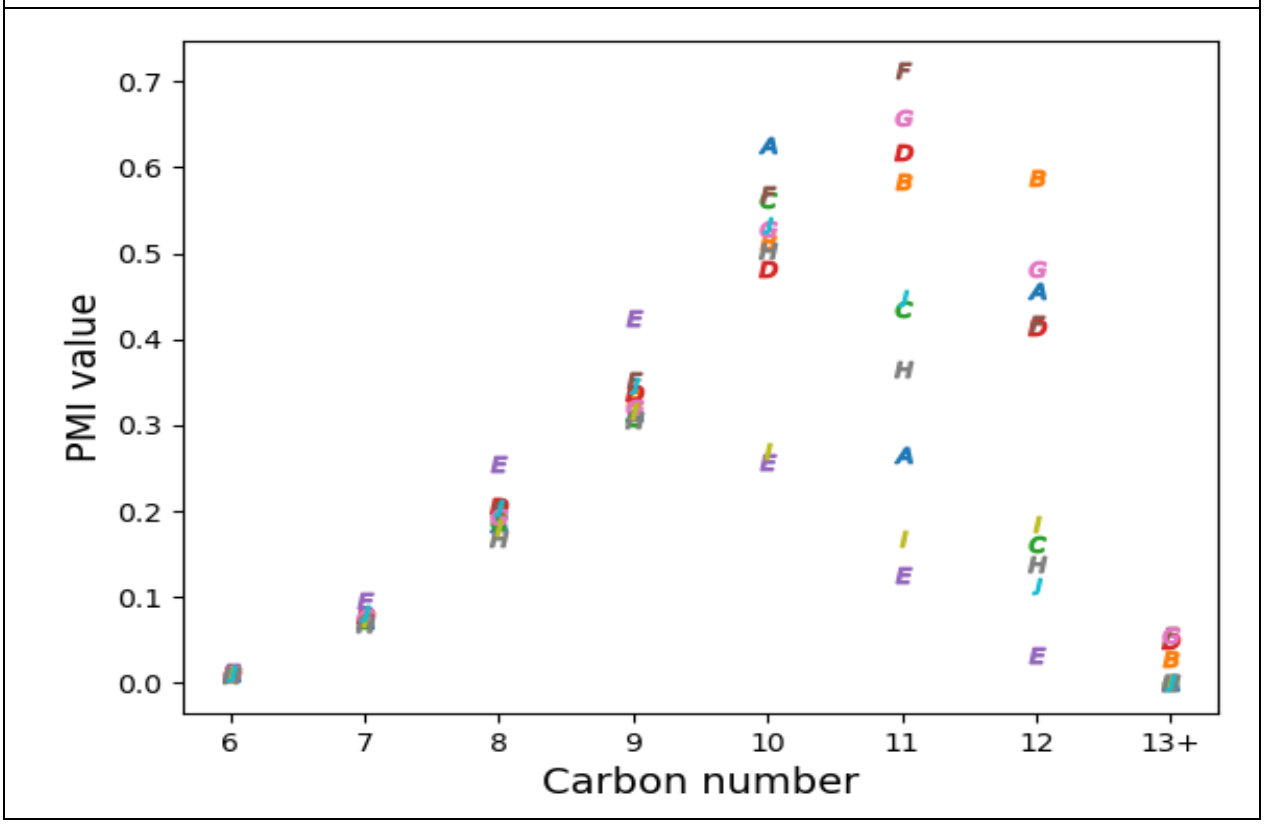


Appendix VI-3

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 3

(Letter symbols indicate Lab identity)

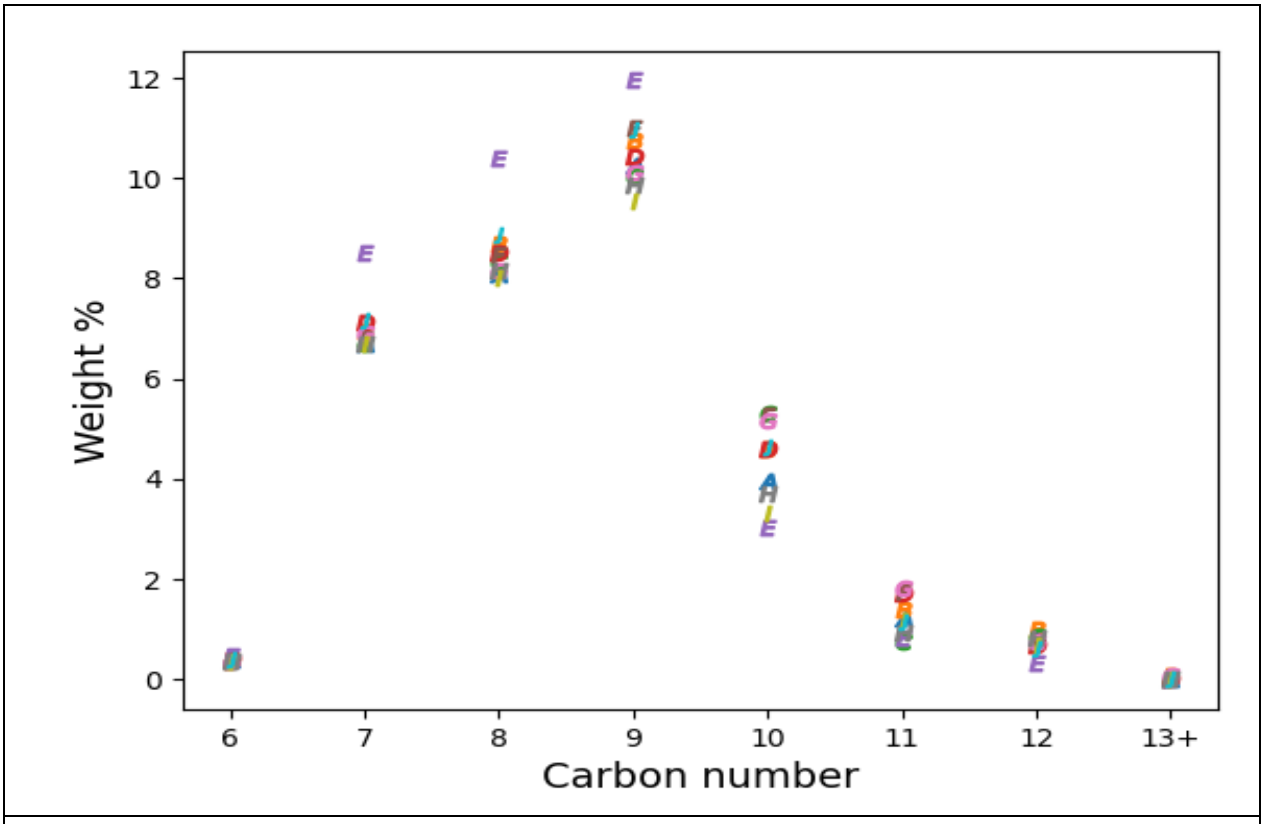


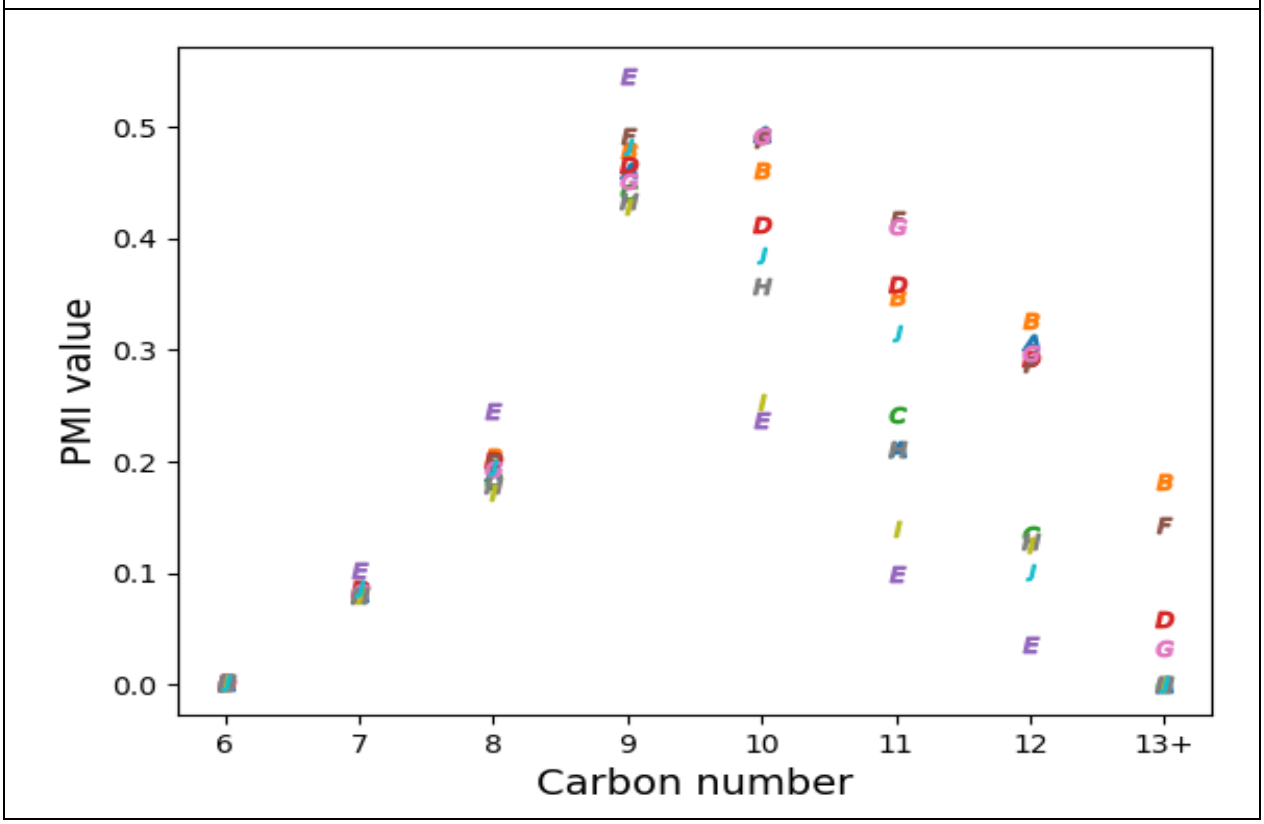


Appendix VI-4

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 4

(Letter symbols indicate Lab identity)

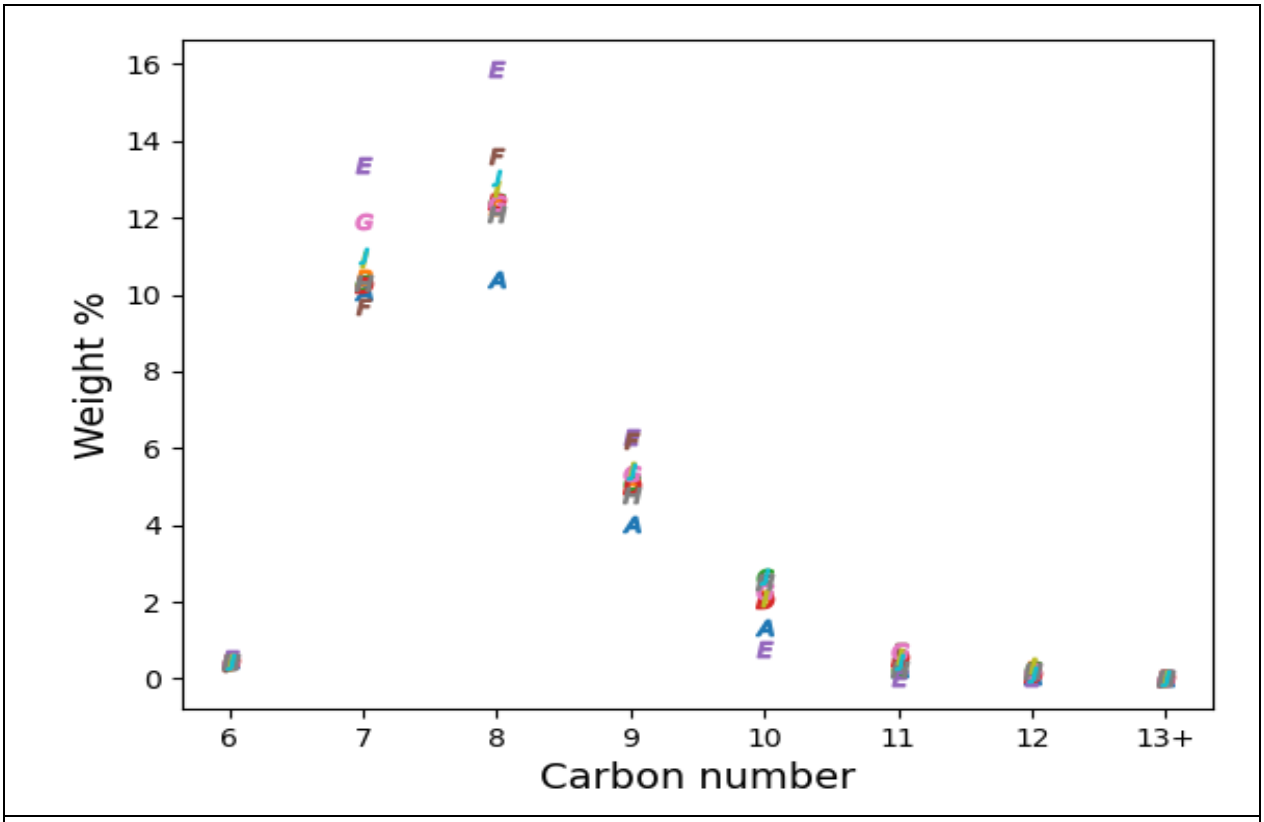


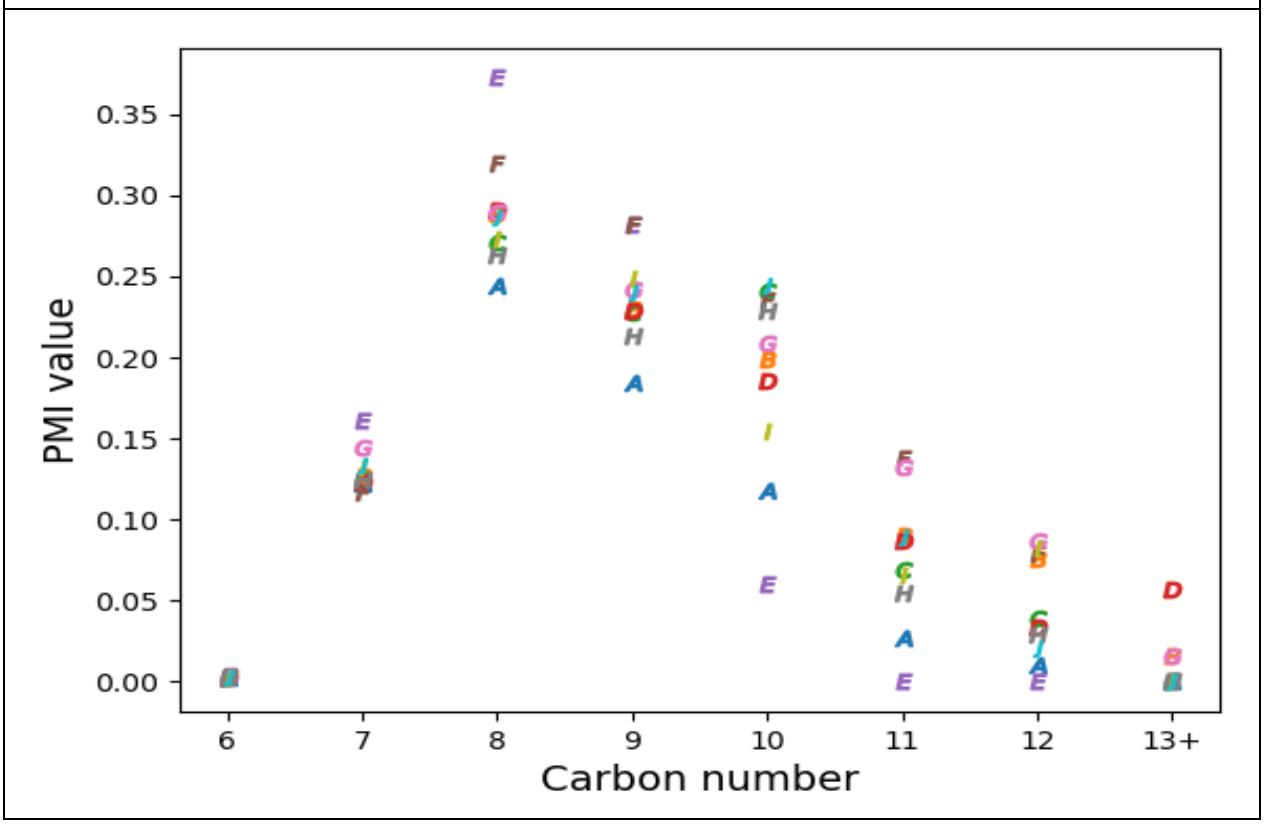


Appendix VI-5

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 5

(Letter symbols indicate Lab identity)

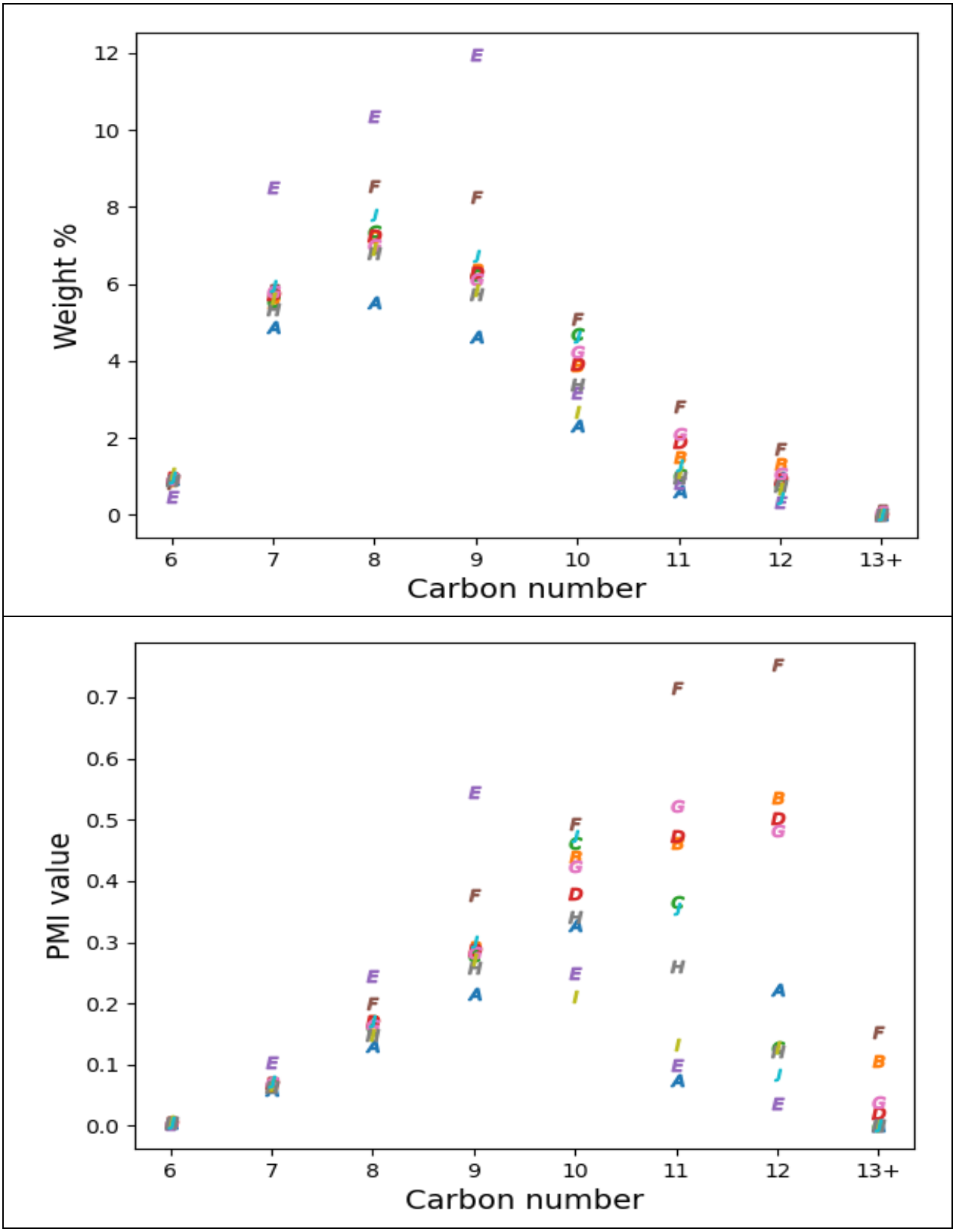




Appendix VI-6

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 6a

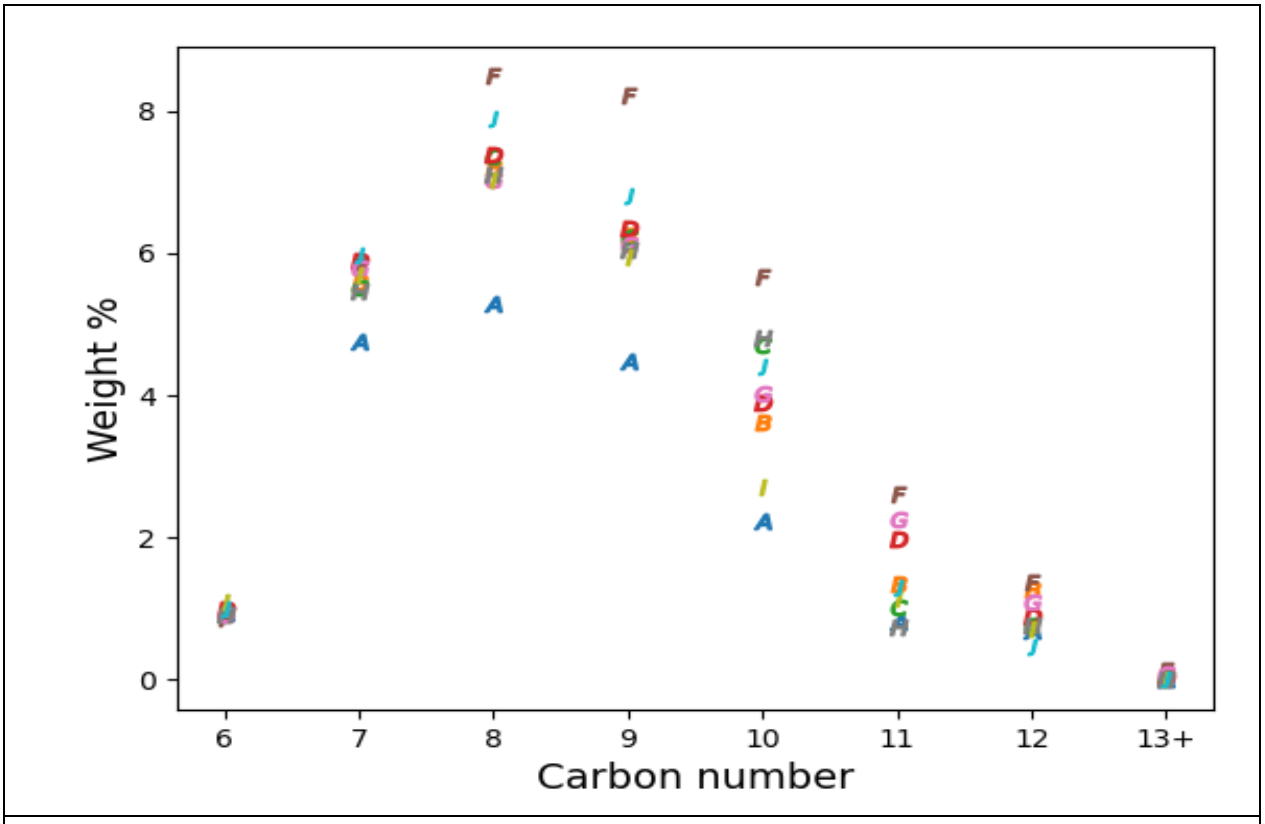
(Letter symbols indicate Lab identity)

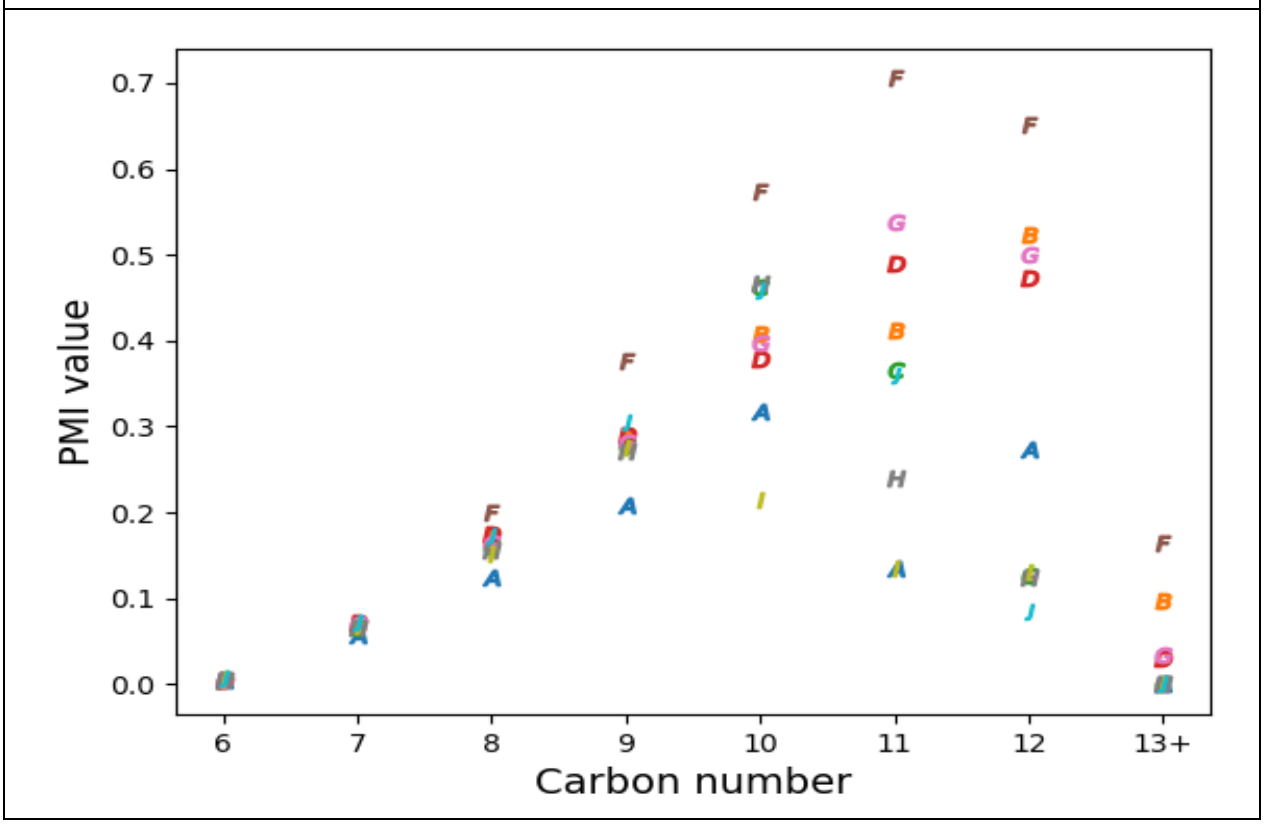


Appendix VI-7

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 6b

(Letter symbols indicate Lab identity)

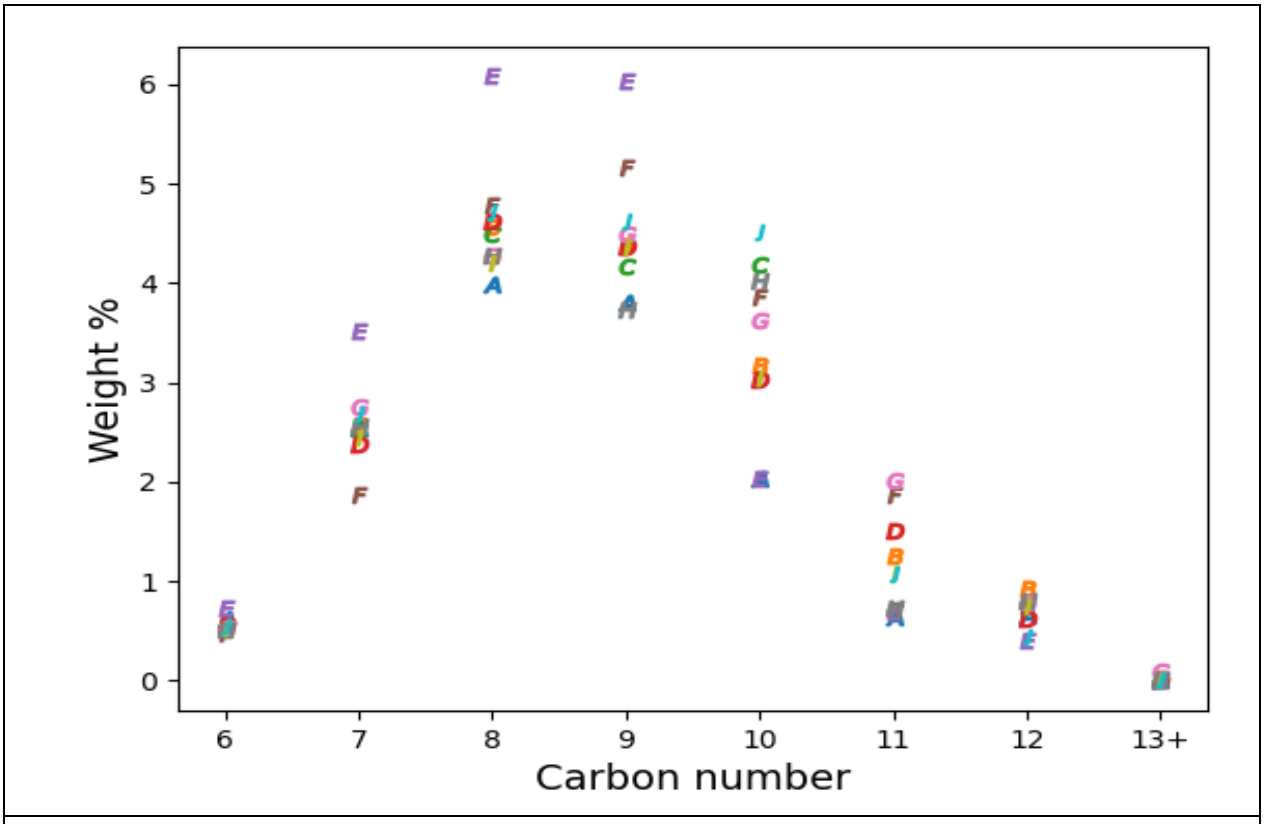


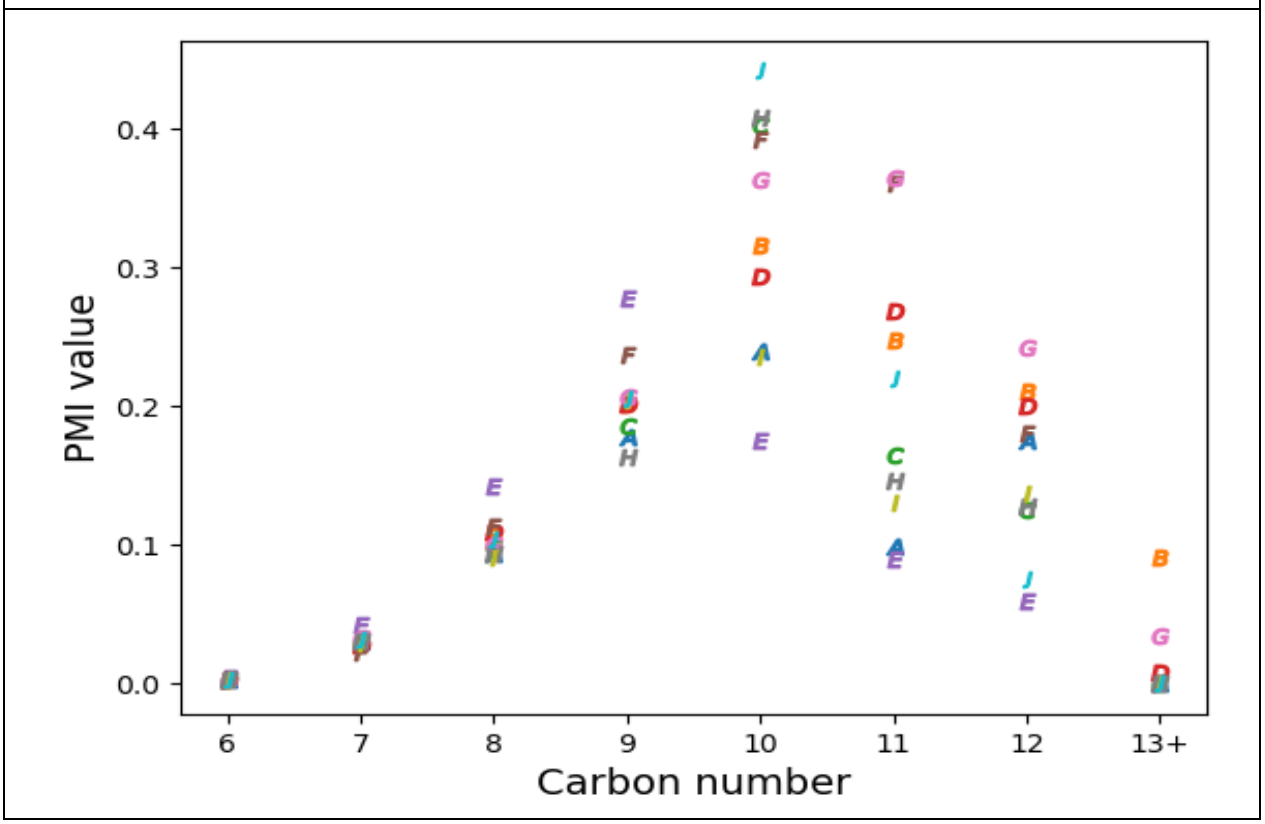


Appendix VI-8

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 7

(Letter symbols indicate Lab identity)

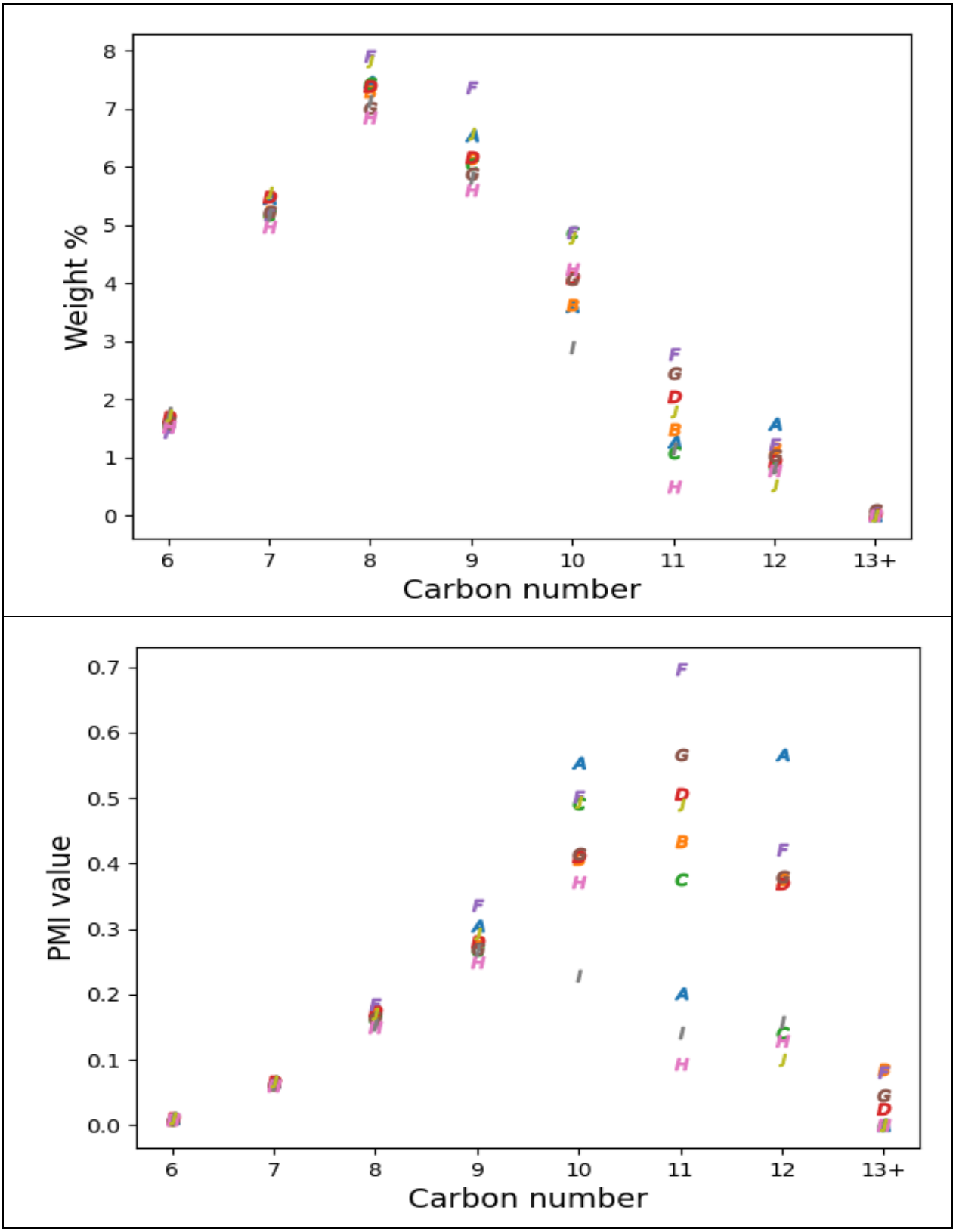




Appendix VI-9

Summary of Wt.% and PMI Contributions of Aromatics by Carbon Number in Fuel 8

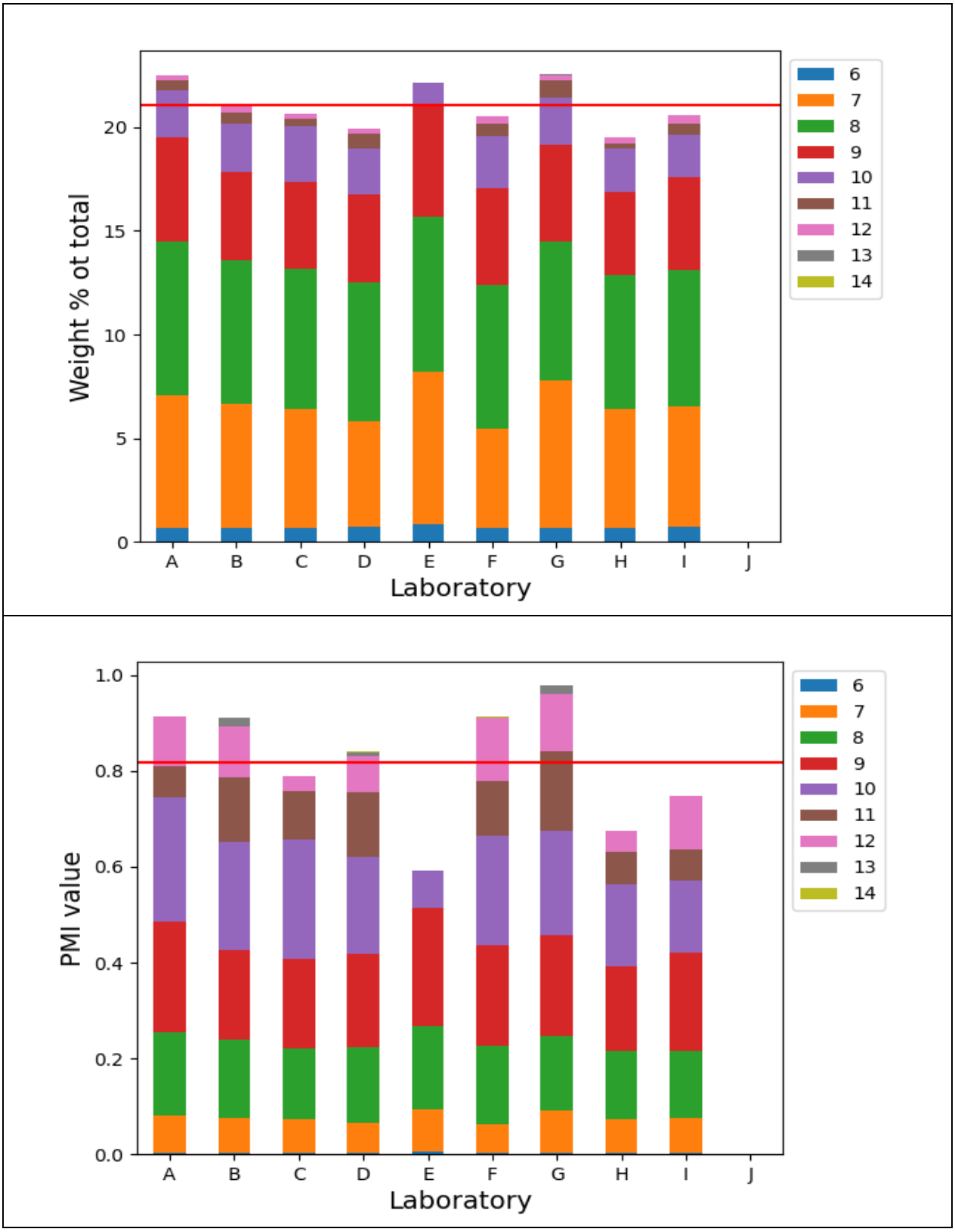
(Letter symbols indicate Lab identity)



Appendix VII-1

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 1

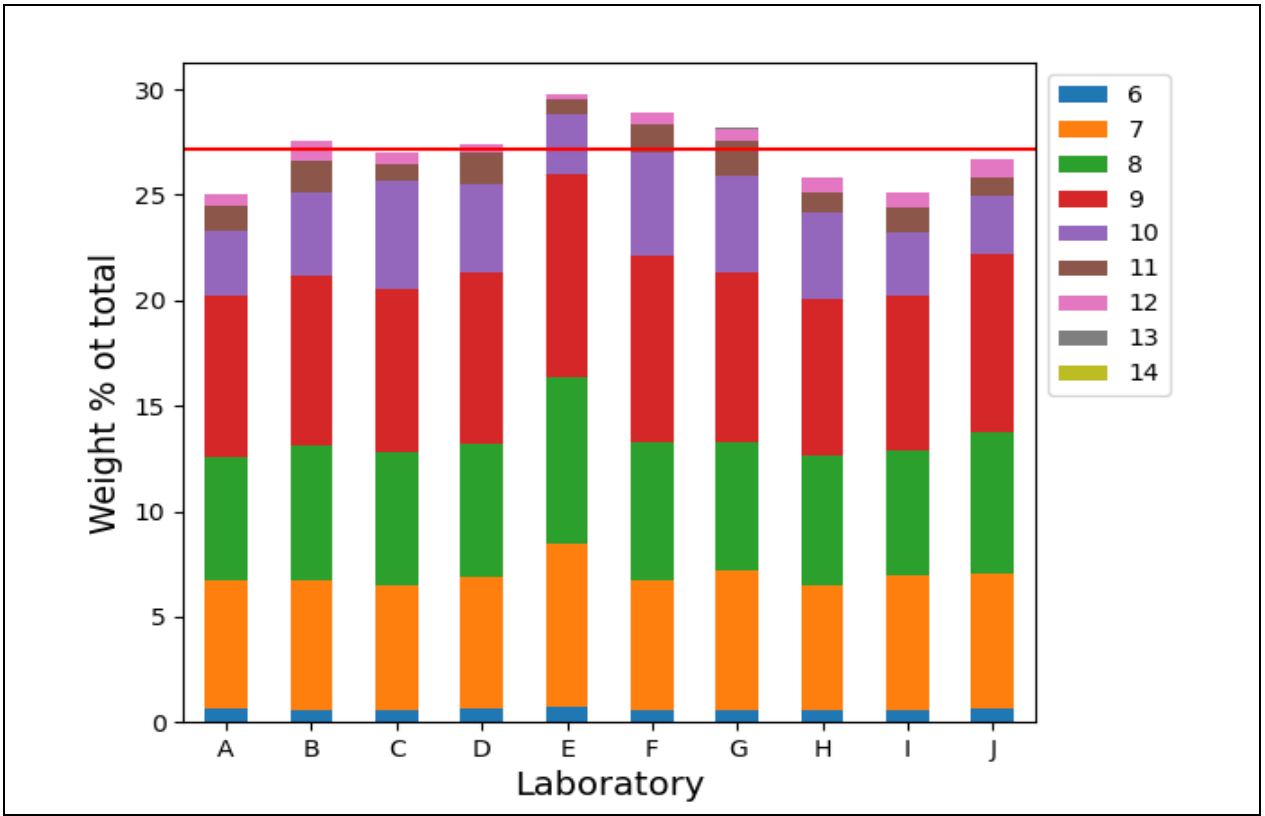
(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs. Lab J was excluded from Fuel 1)

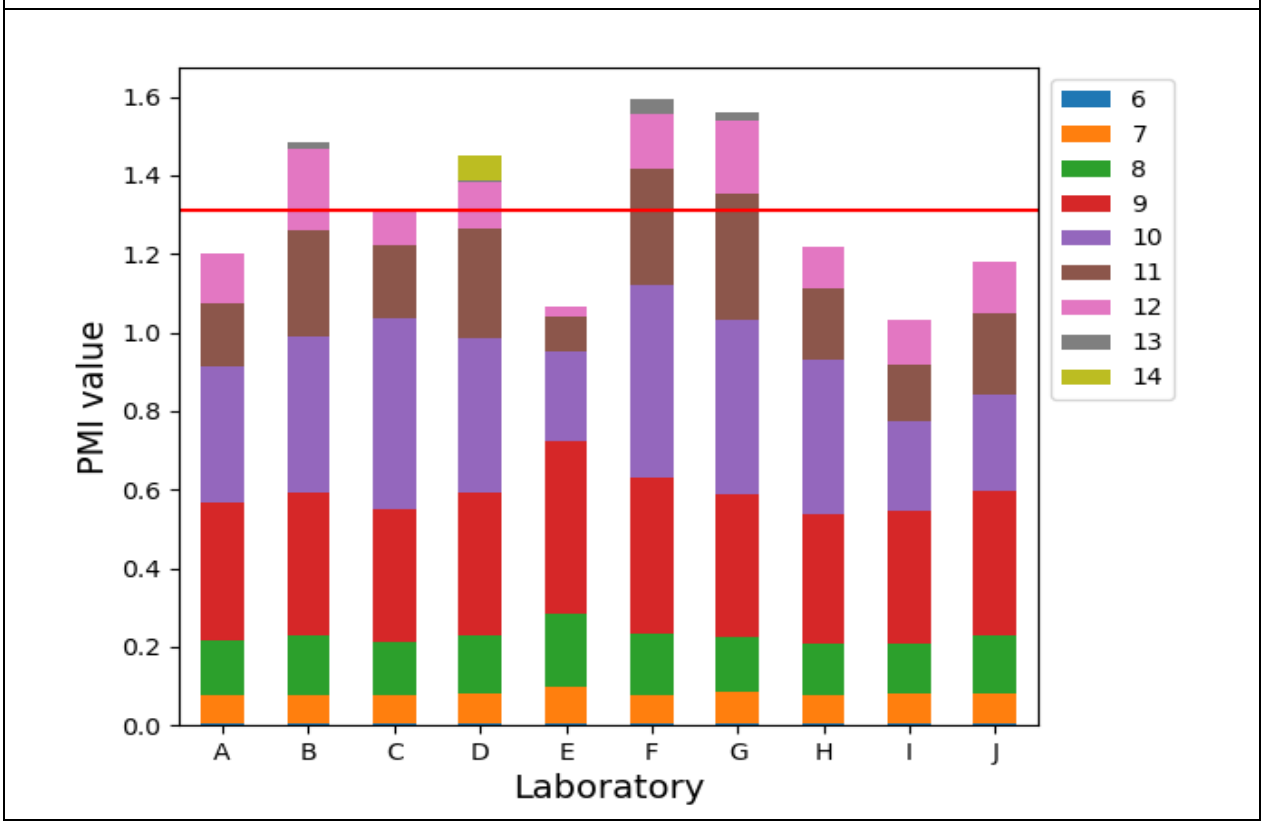


Appendix VII-2

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 2

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

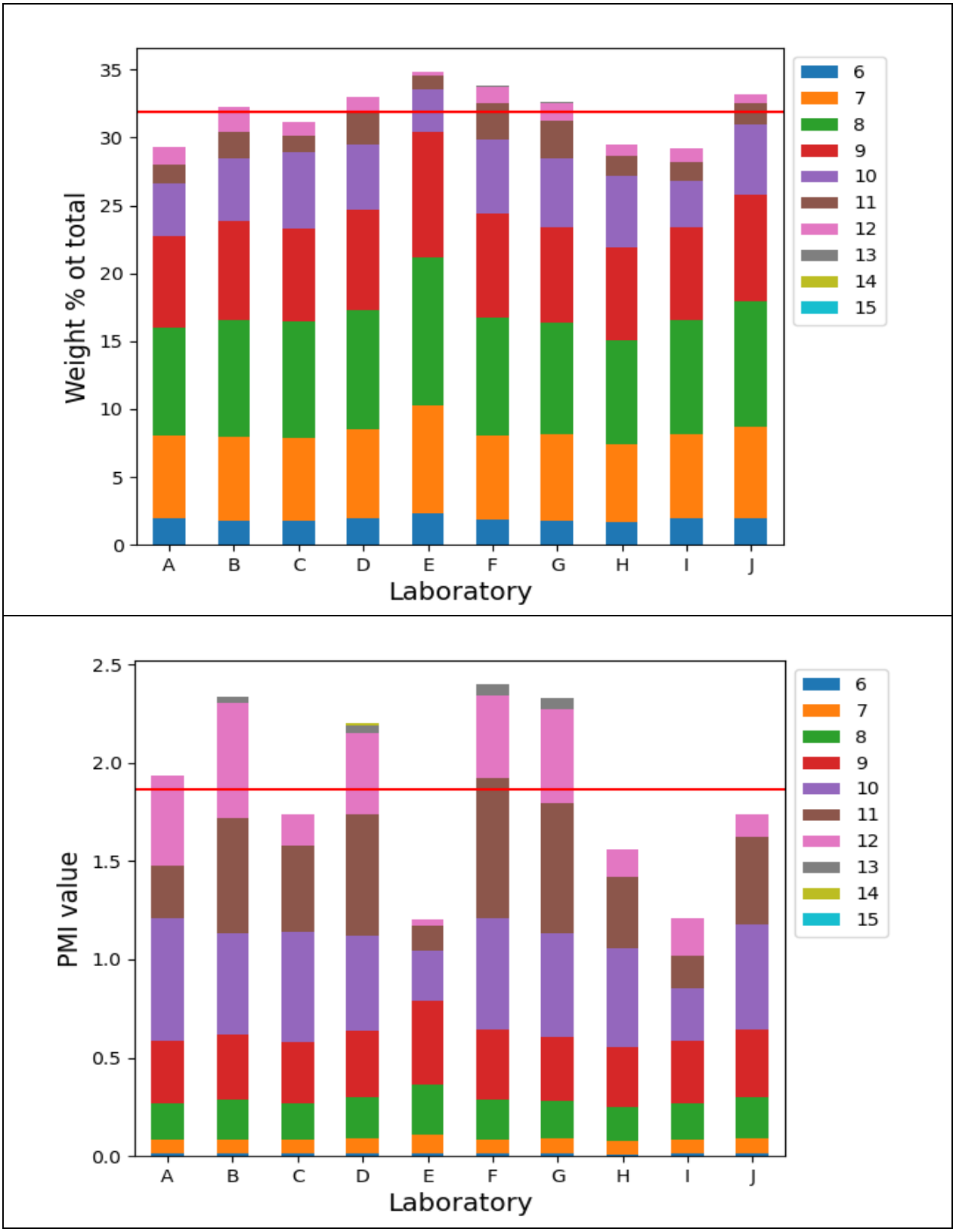




Appendix VII-3

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 3

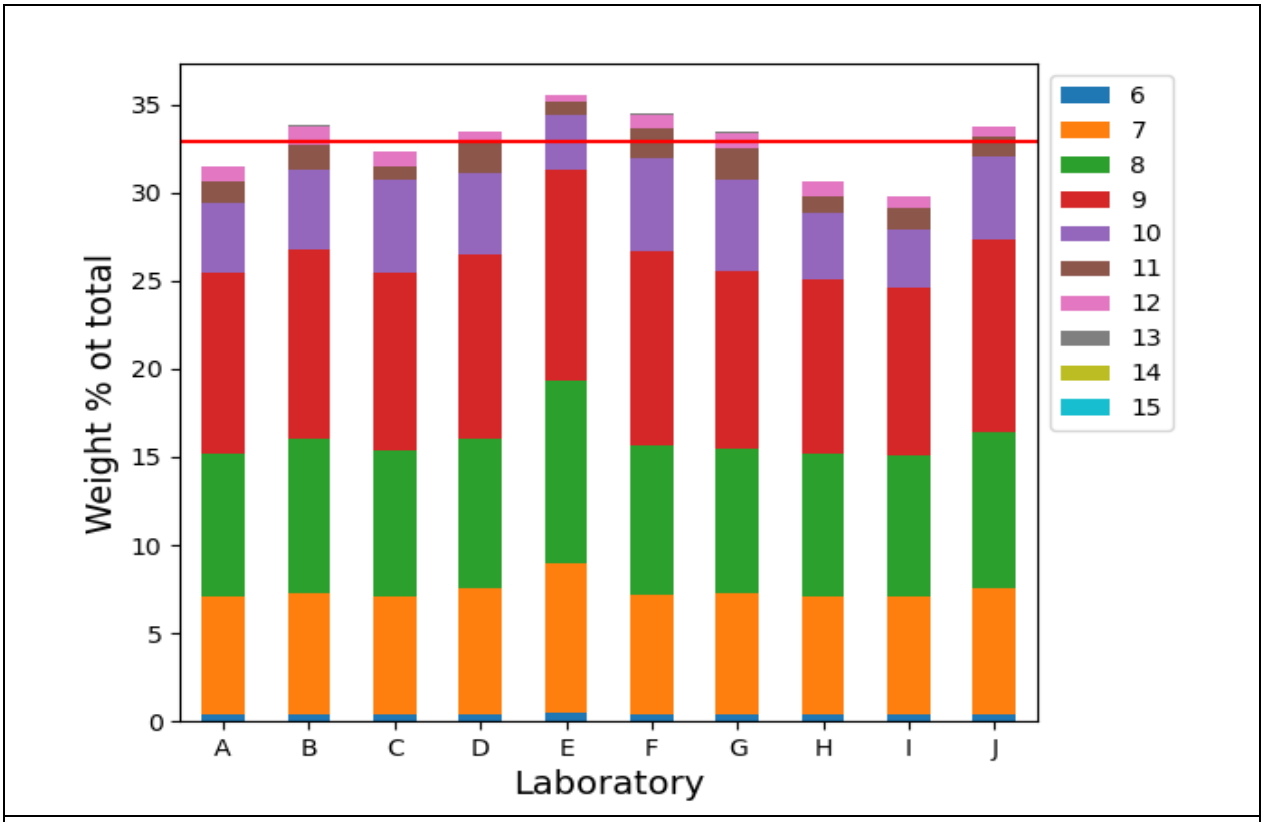
(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

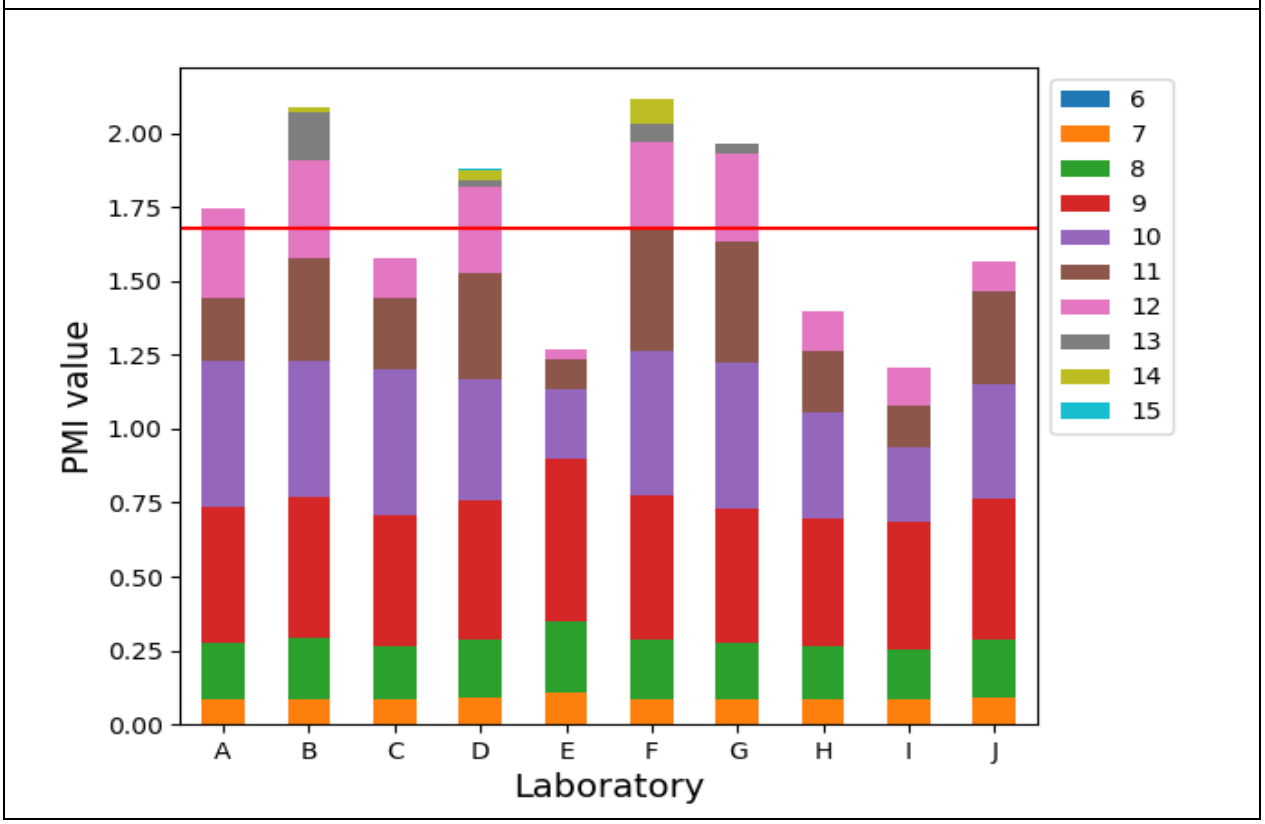


Appendix VII-4

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 4

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

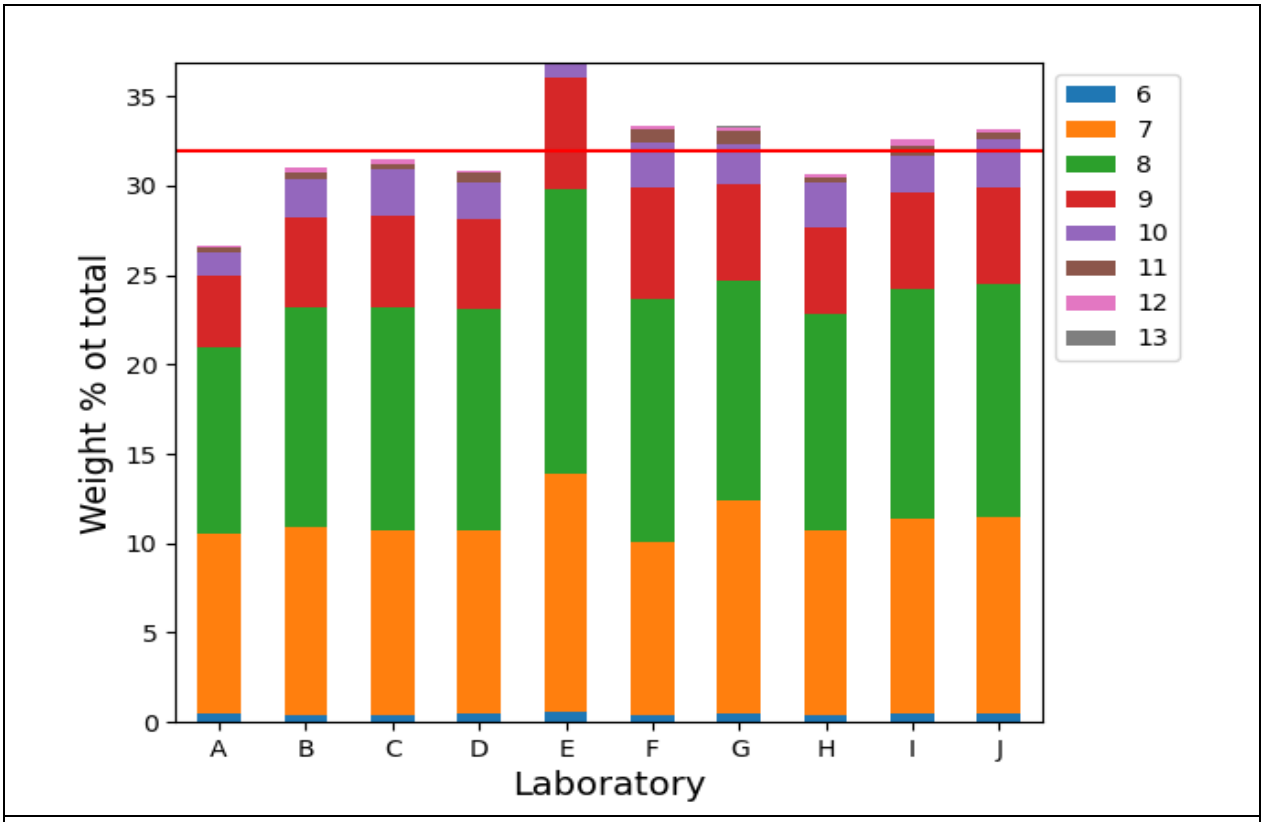


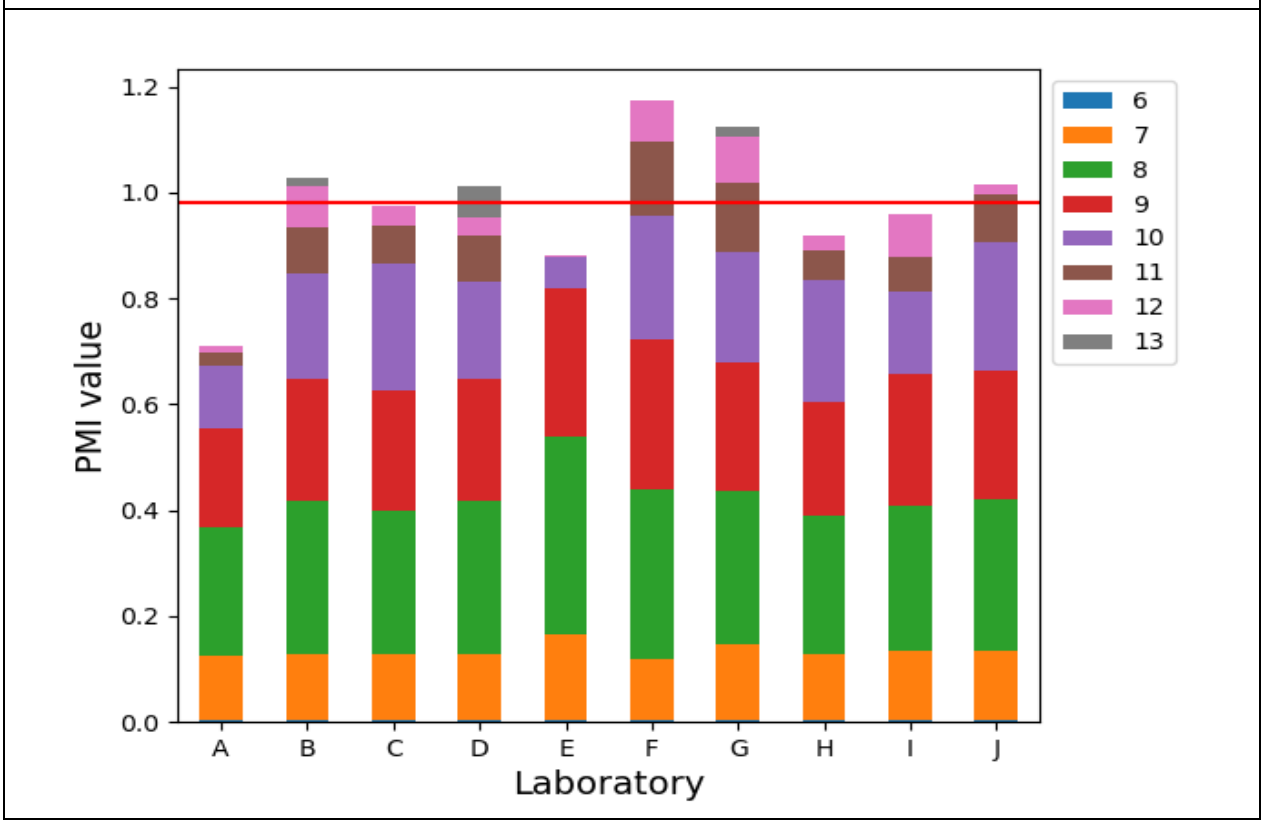


Appendix VII-5

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 5

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

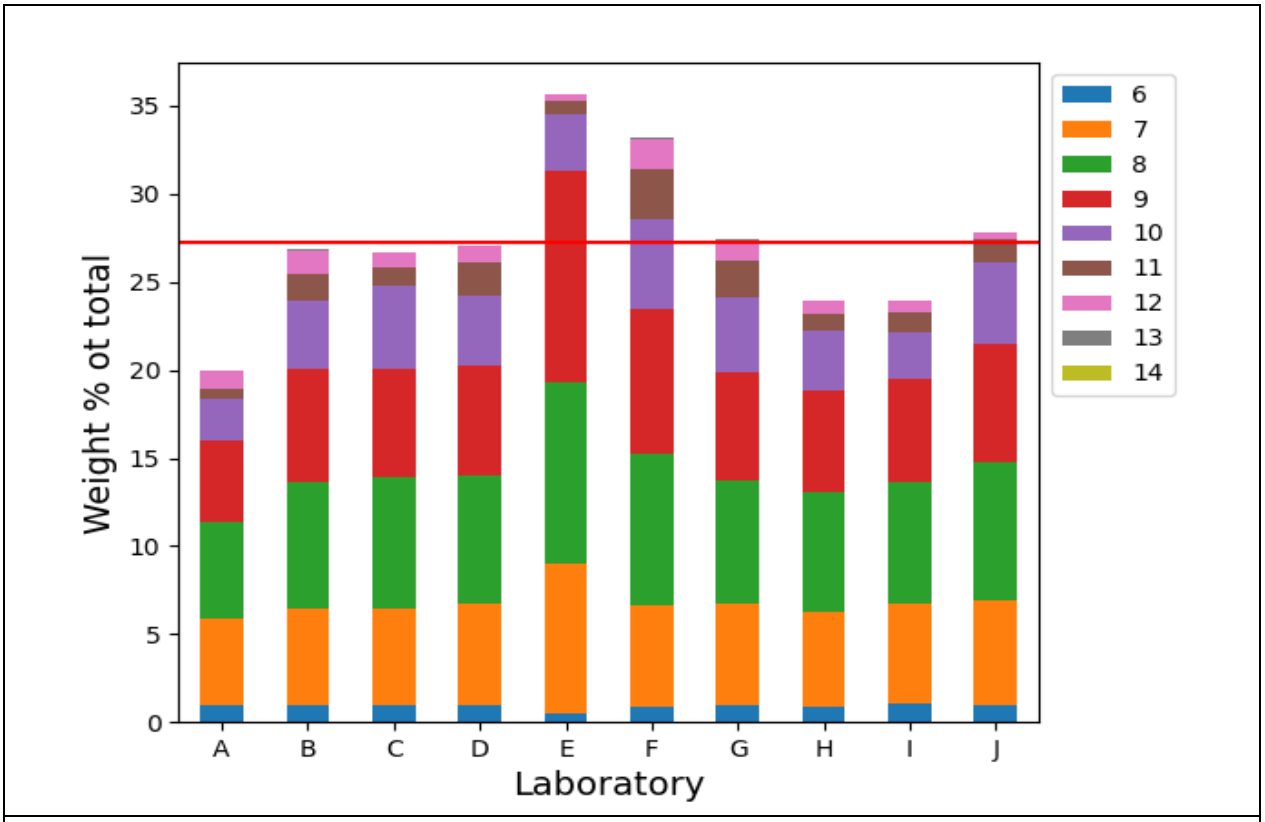


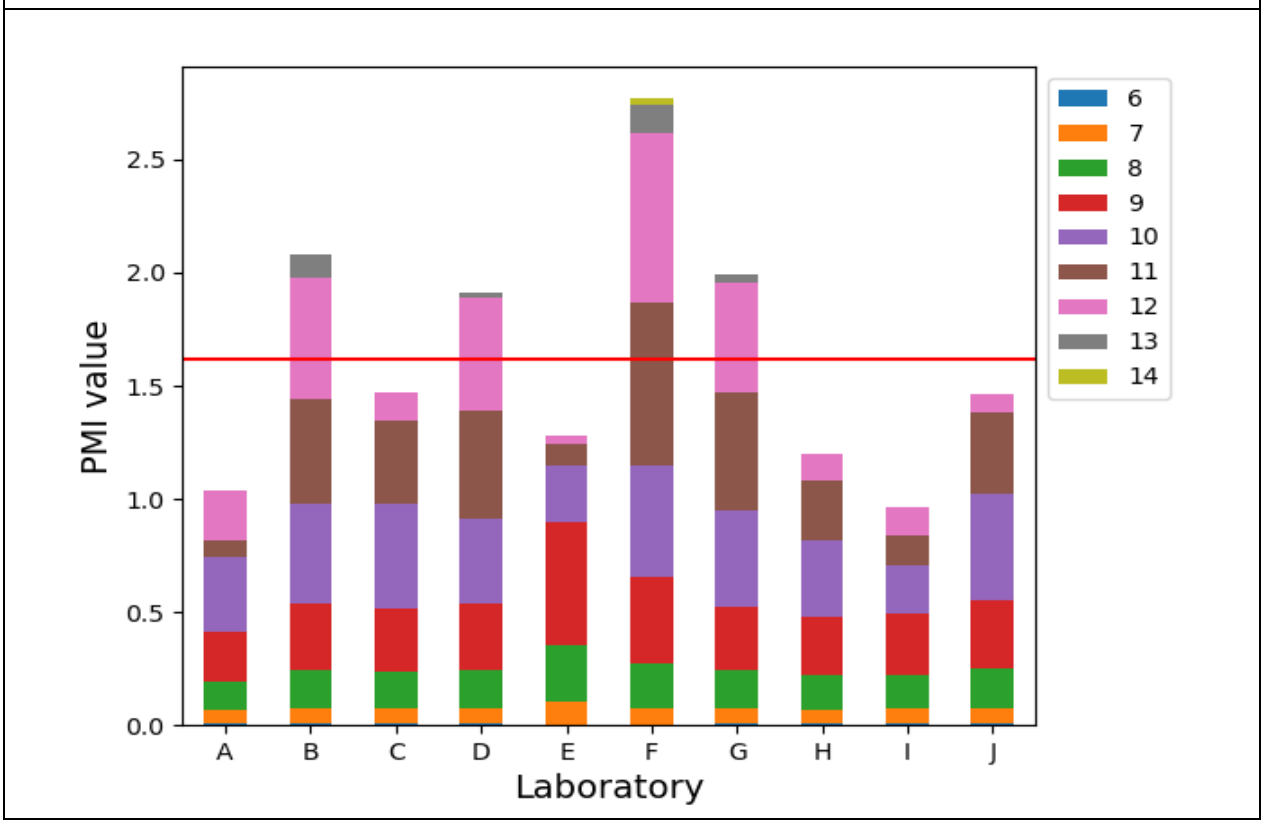


Appendix VII-6

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 6a

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

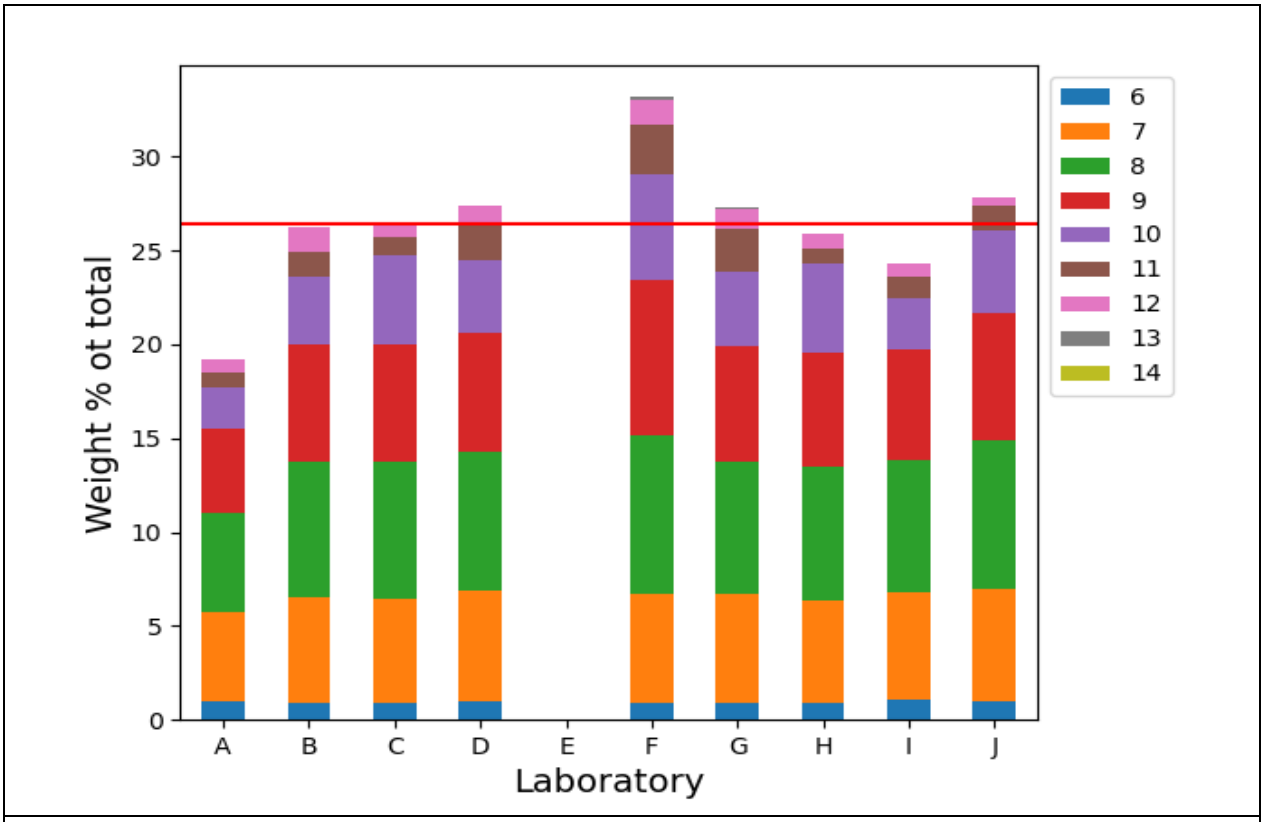


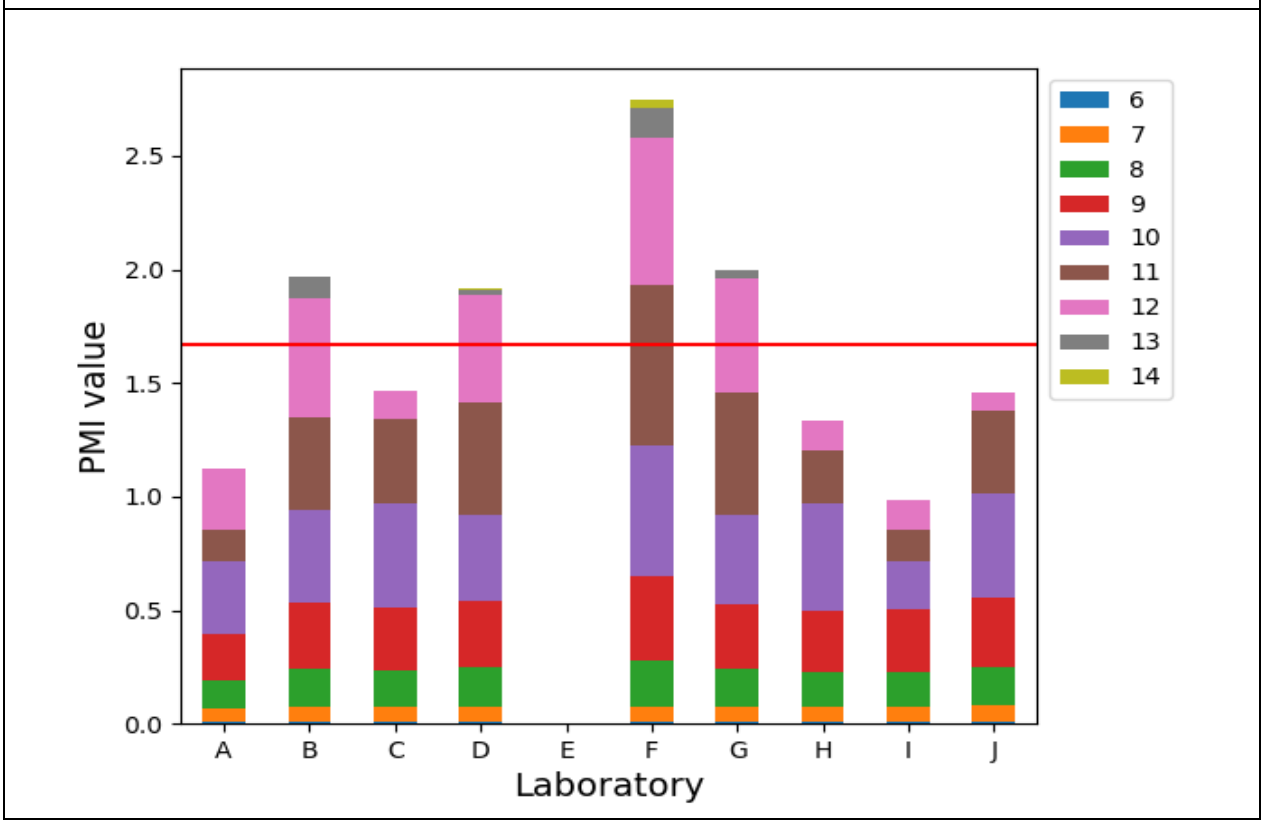


Appendix VII-7

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 6b

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

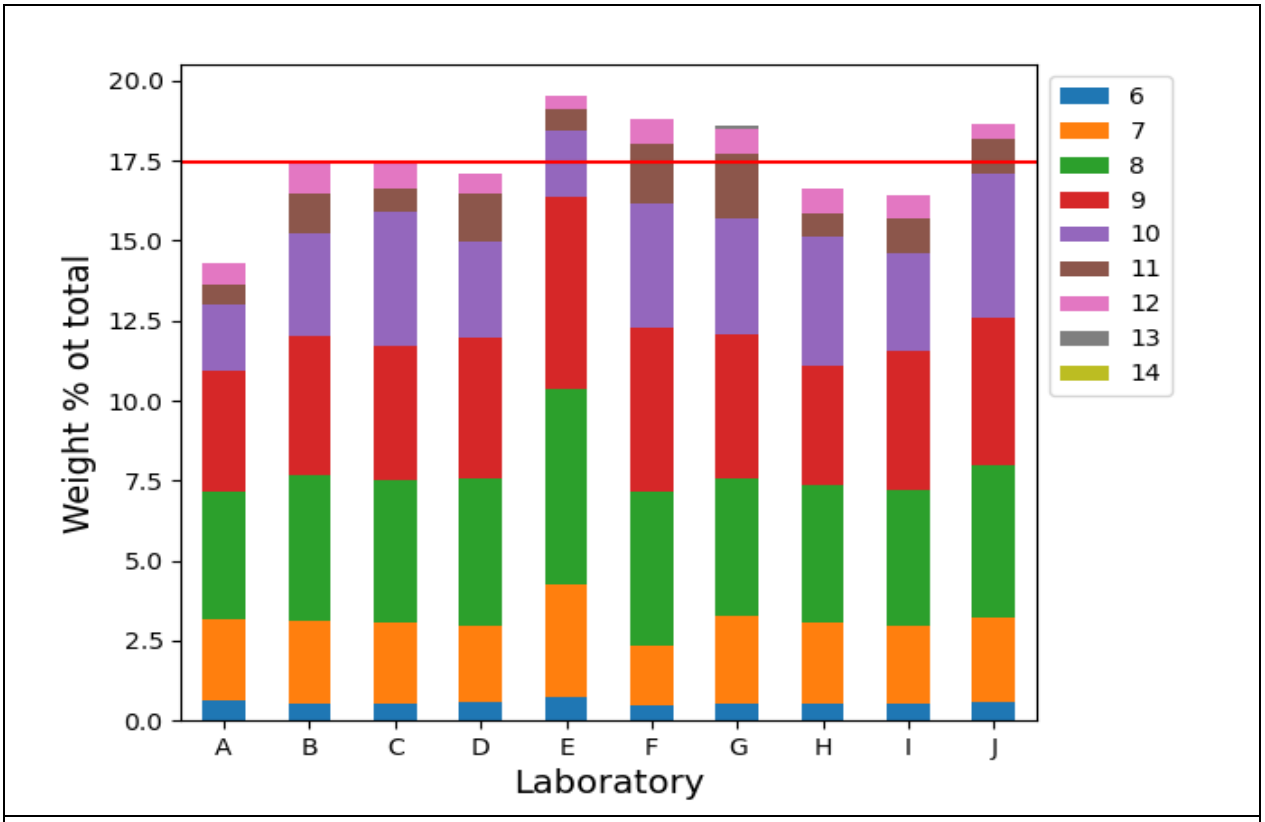


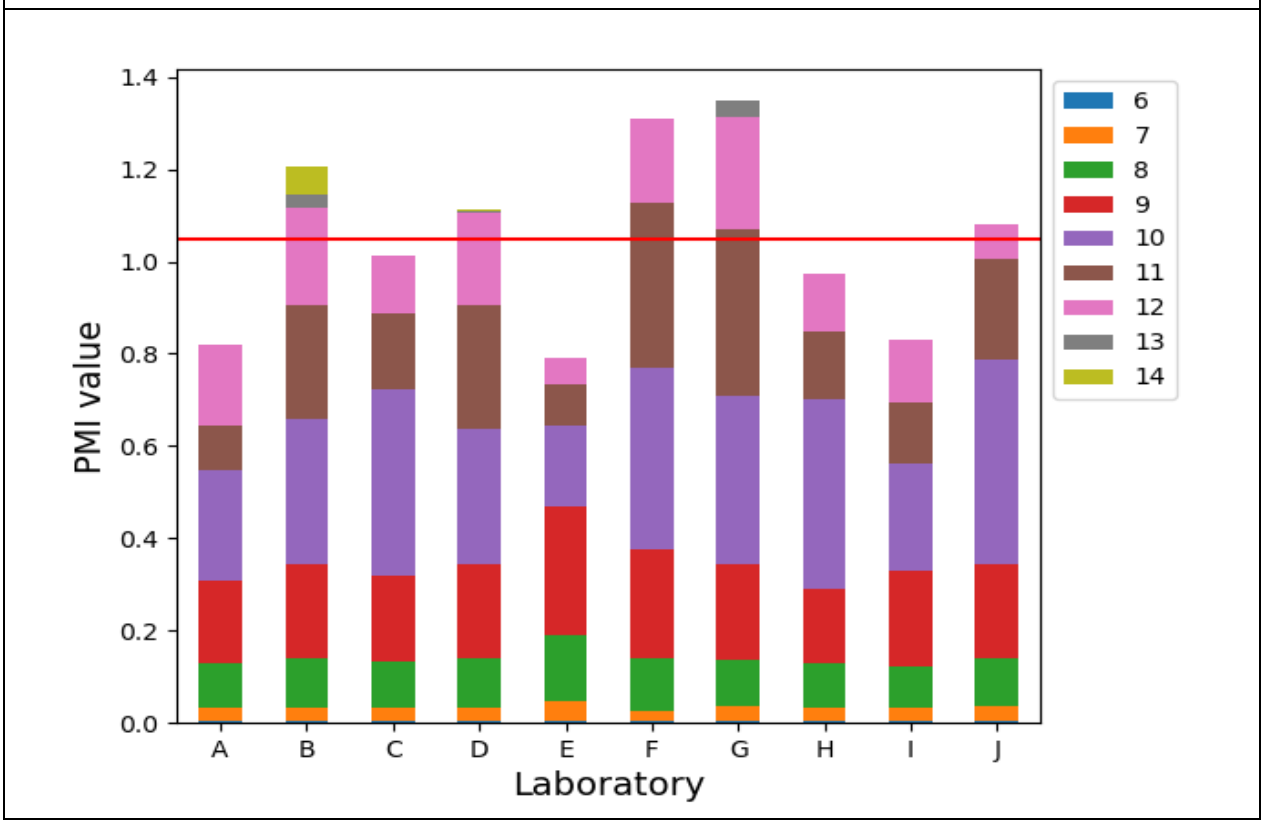


Appendix VII-8

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 7

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

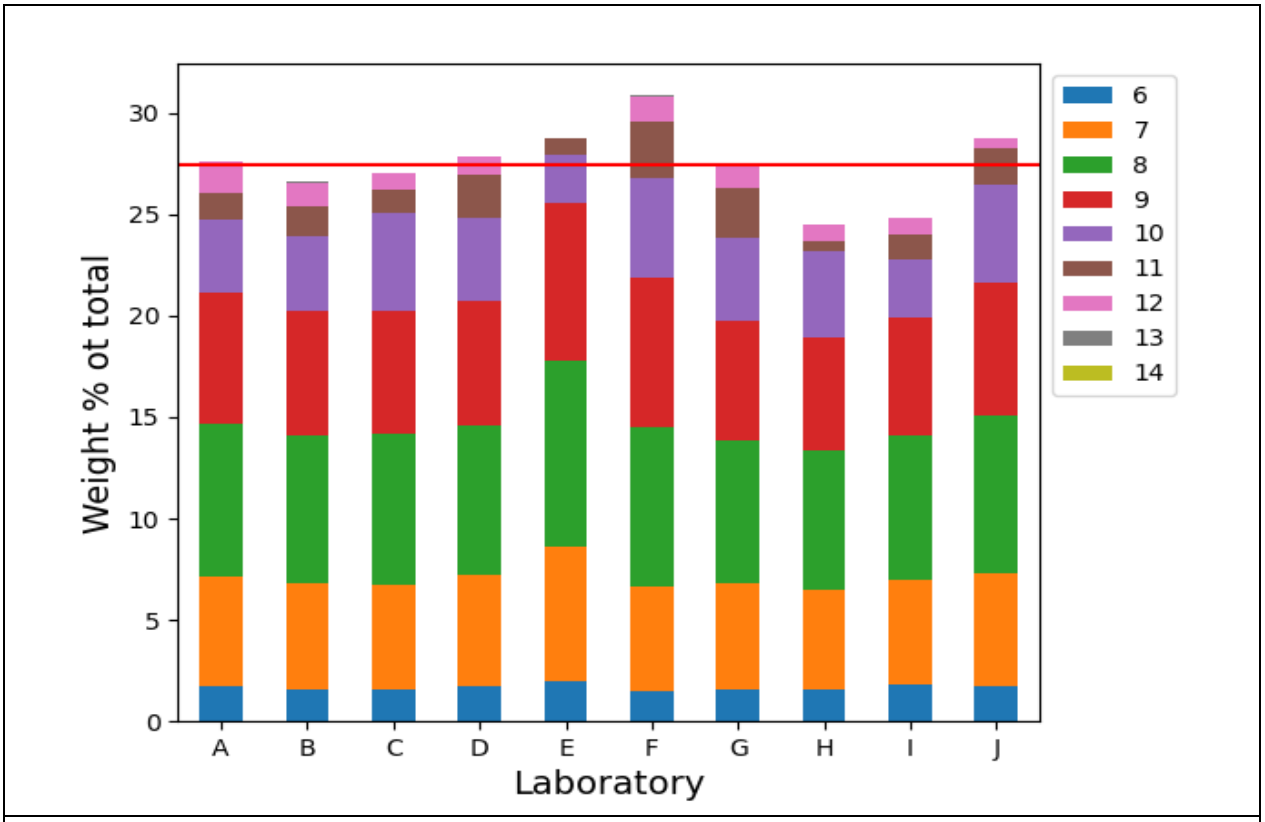


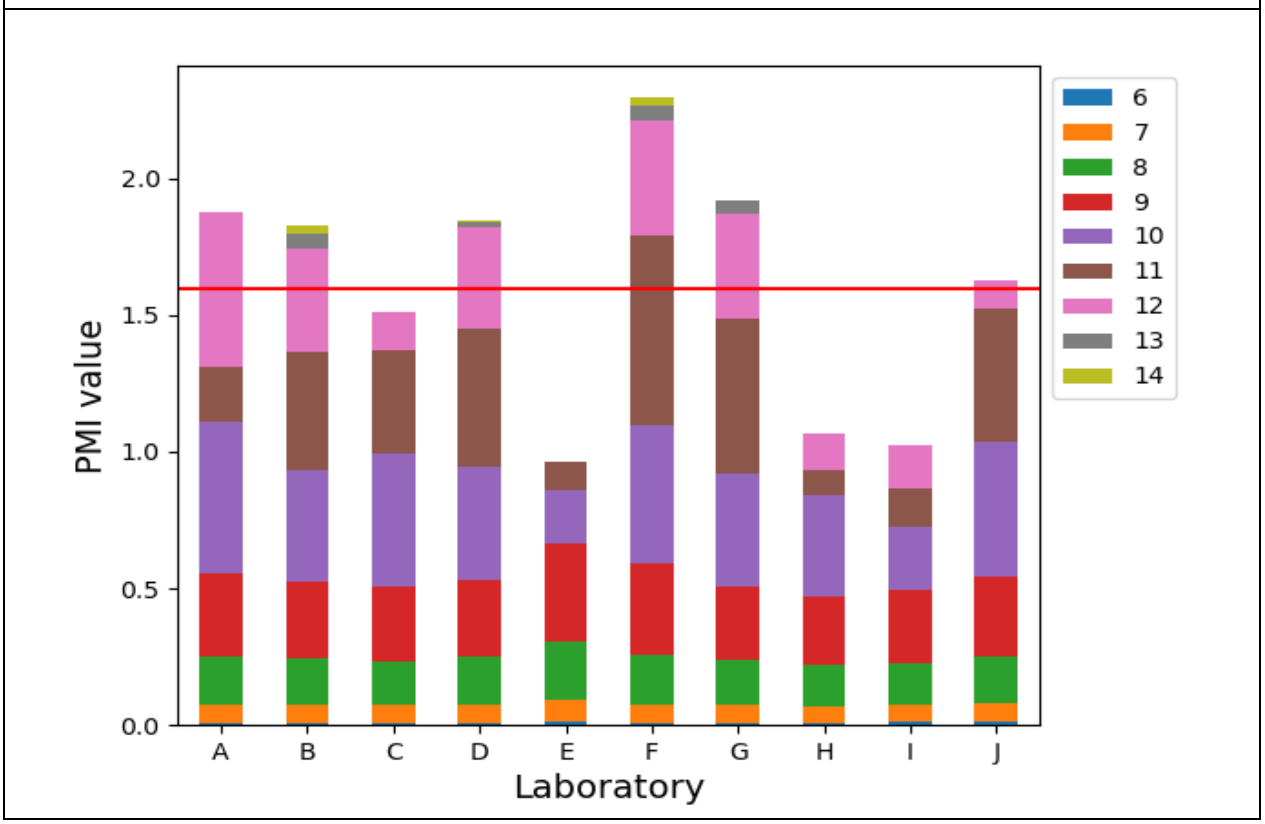


Appendix VII-9

Summary of Wt.% and PMI Contributions of Aromatics by Laboratory in Fuel 8

(Colored bar segments indicate carbon number. Horizontal line indicates mean of all labs.)

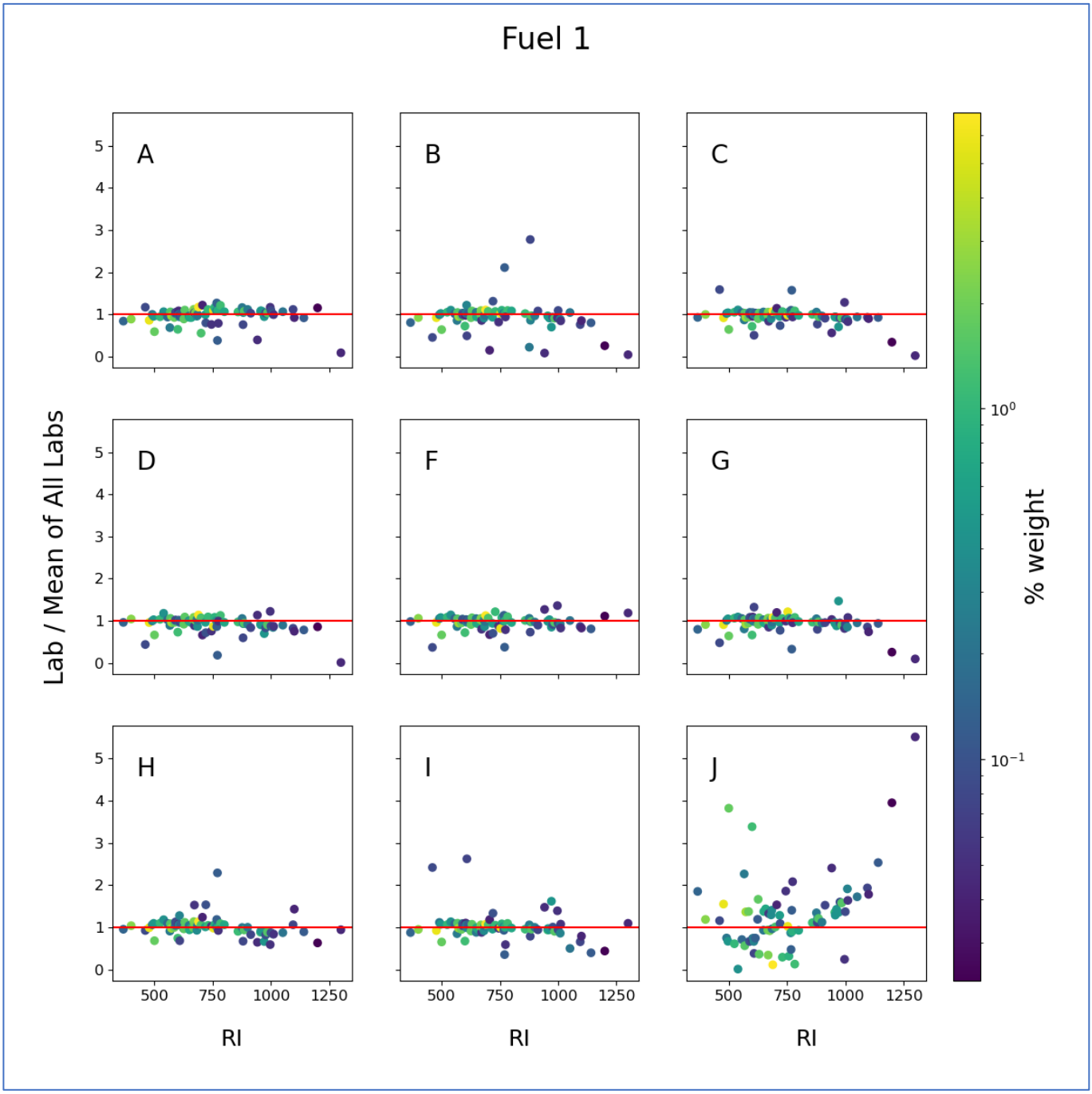




Appendix VIII-1

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 1

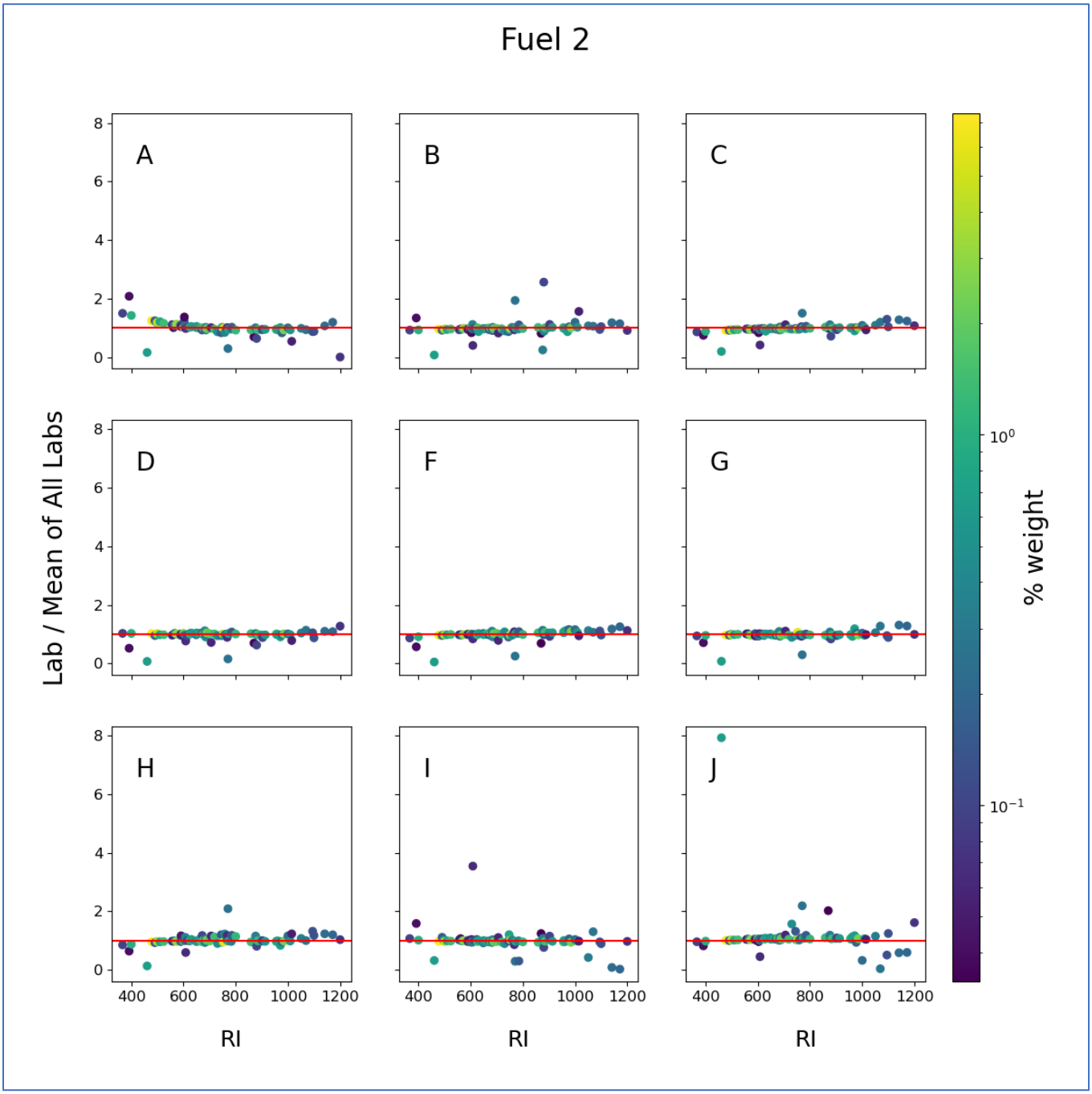
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-2

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 2

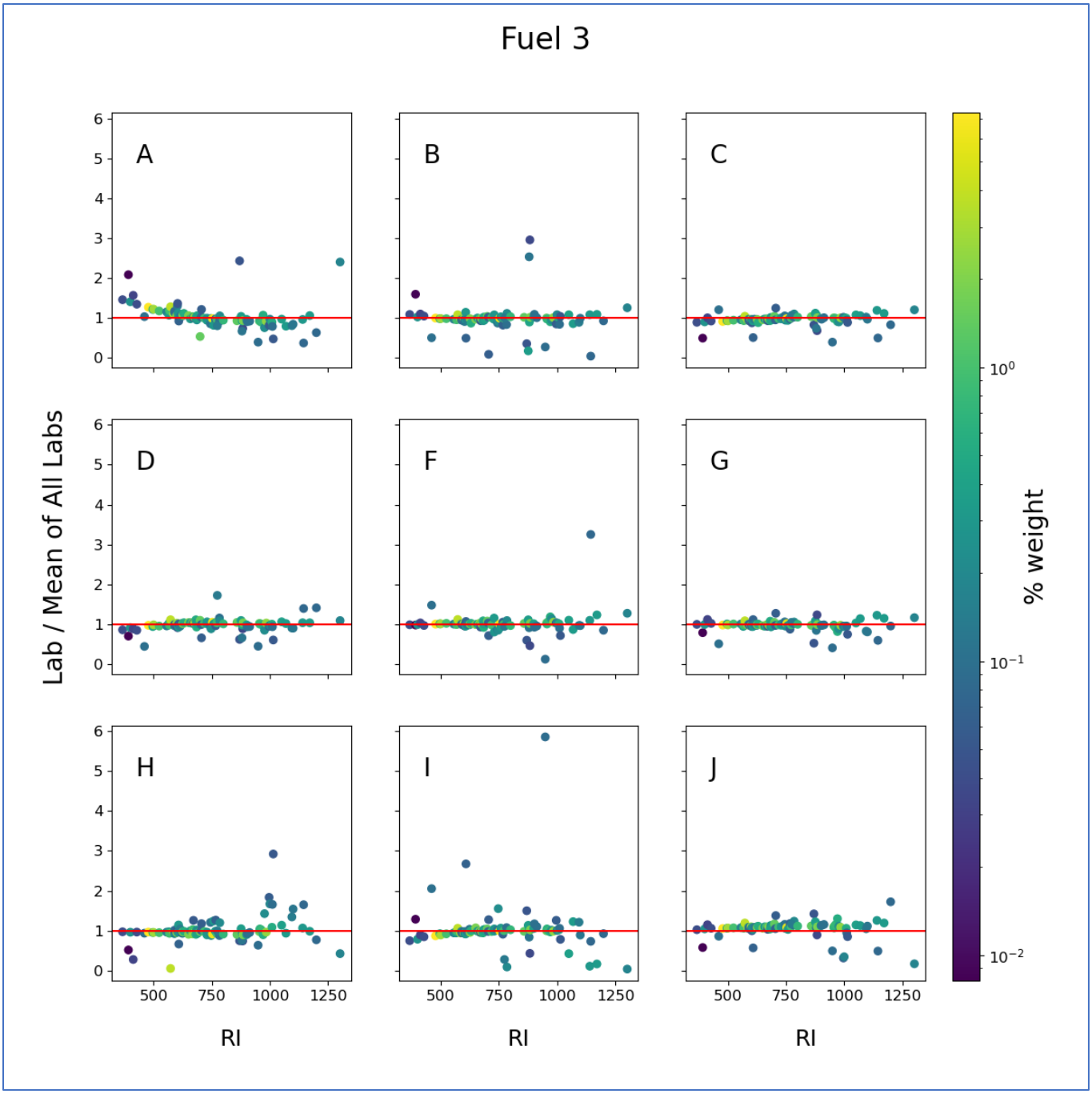
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-3

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 3

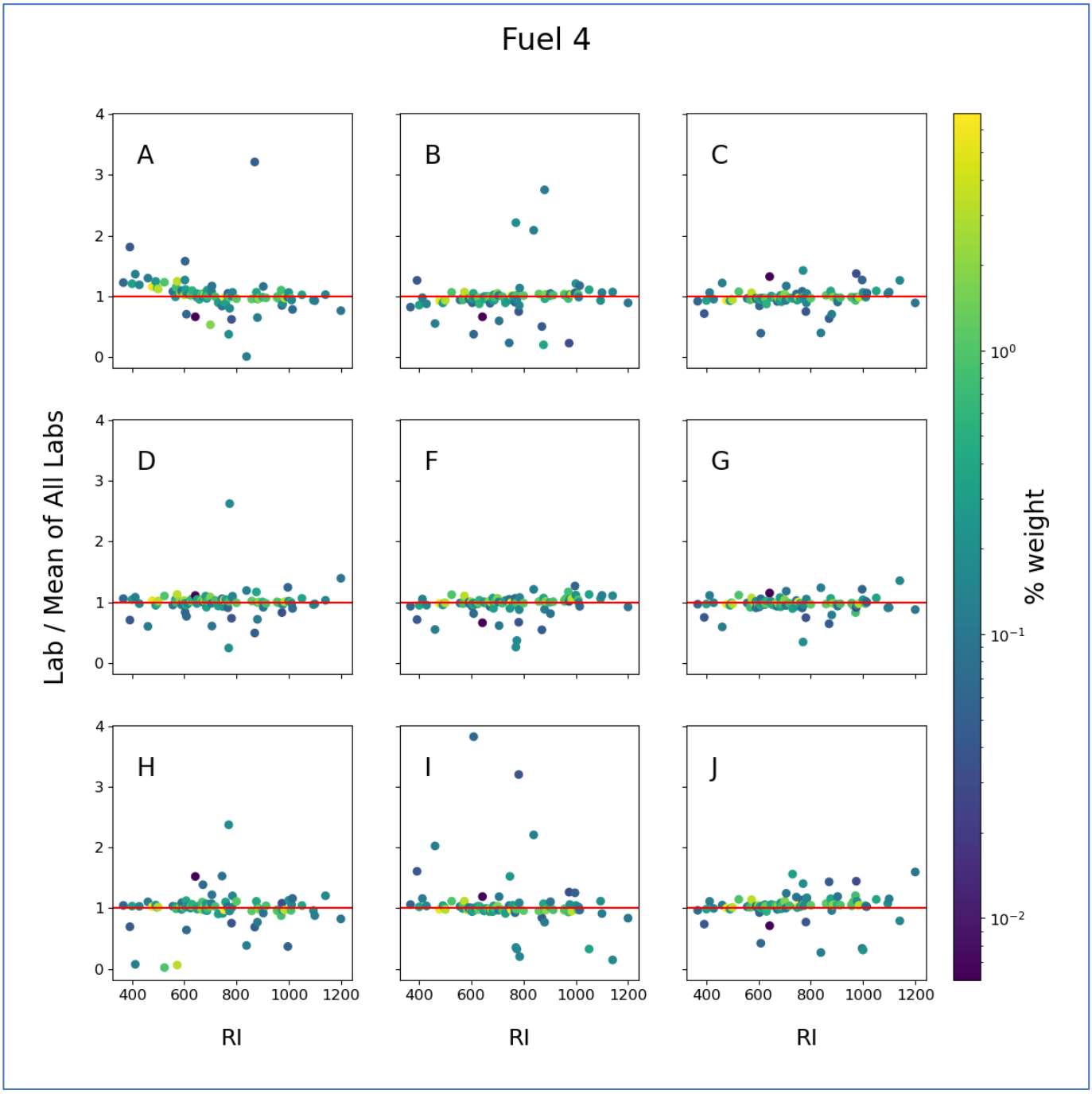
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-4

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 4

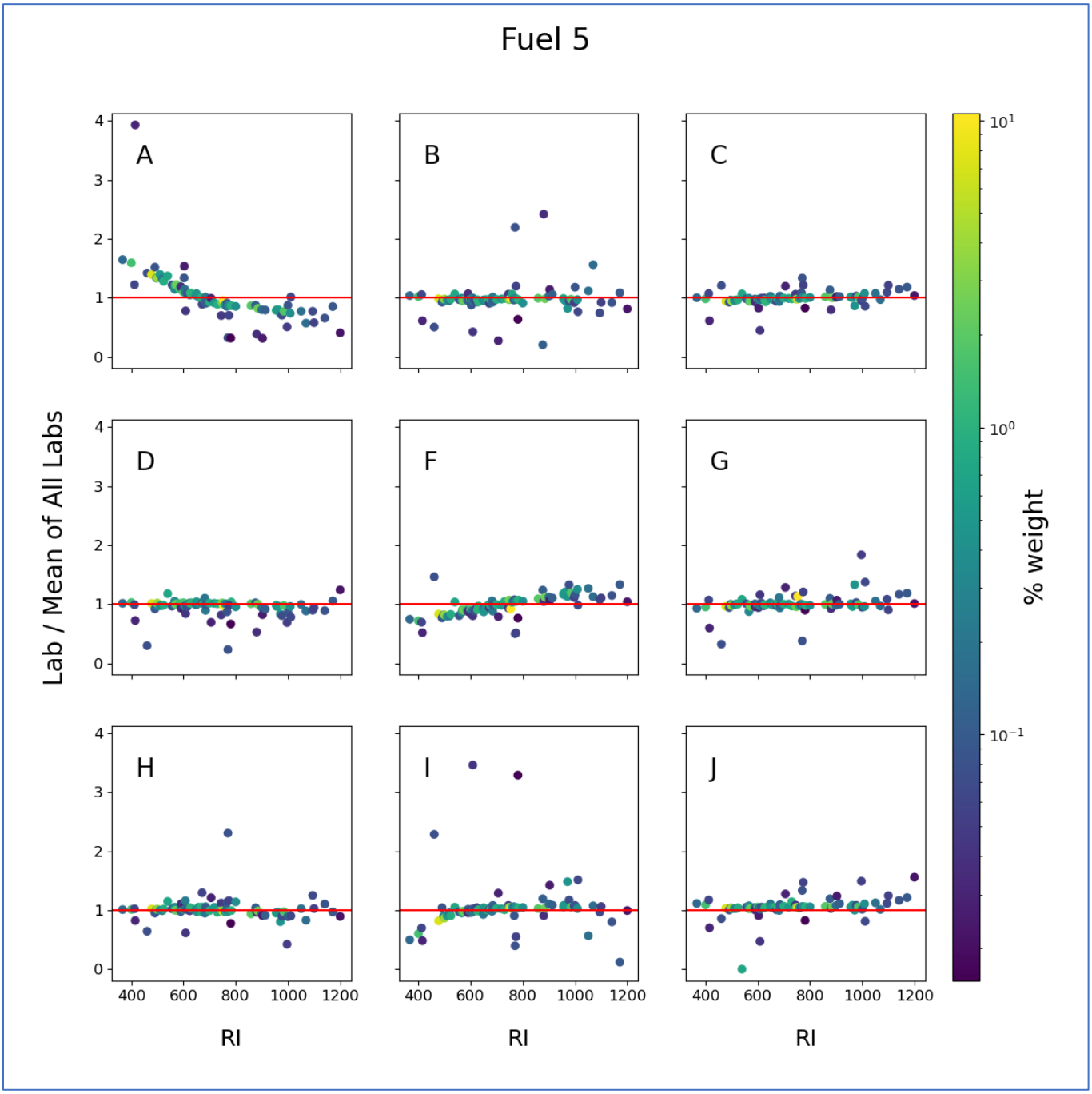
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-5

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 5

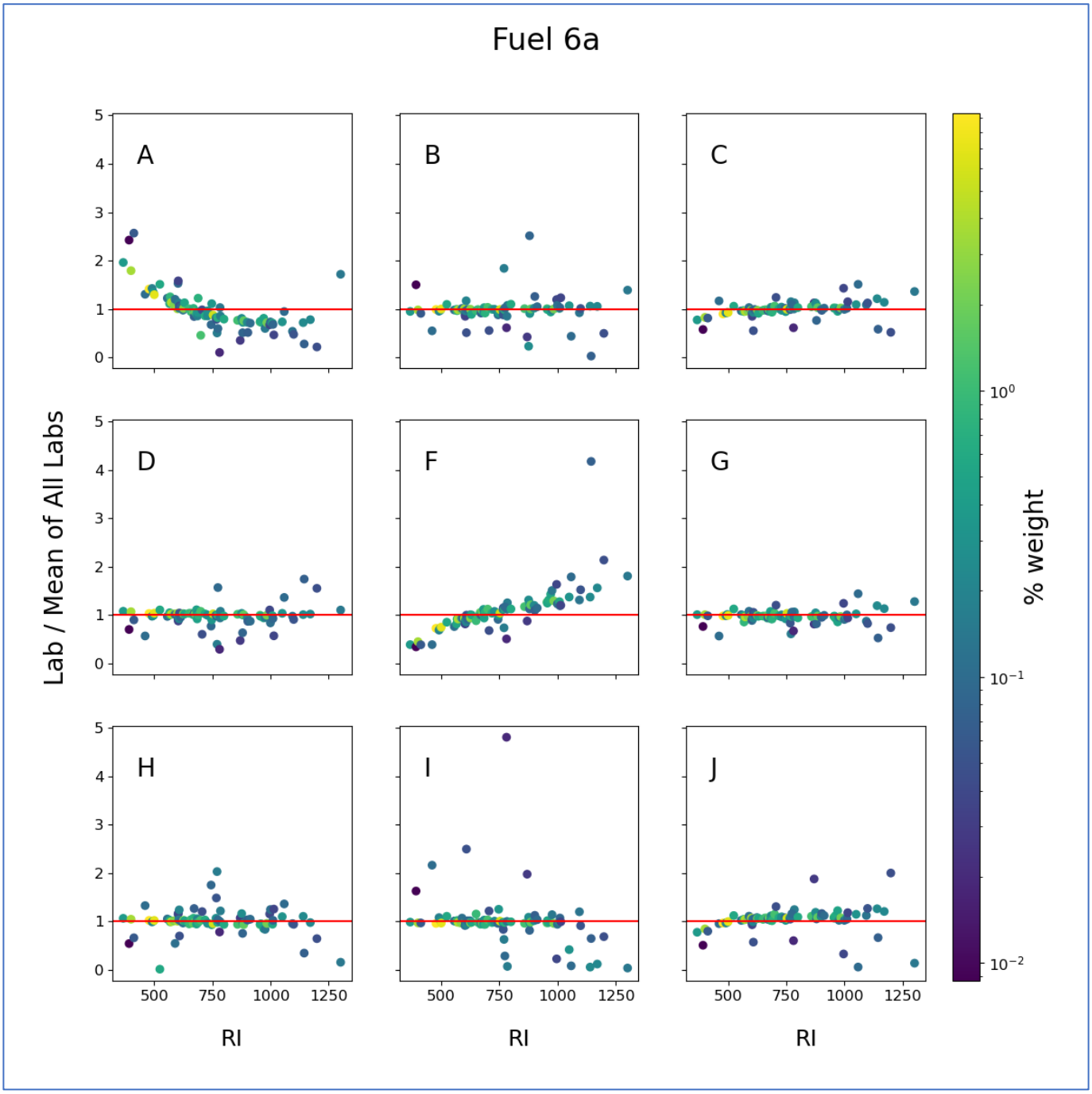
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-6

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 6a

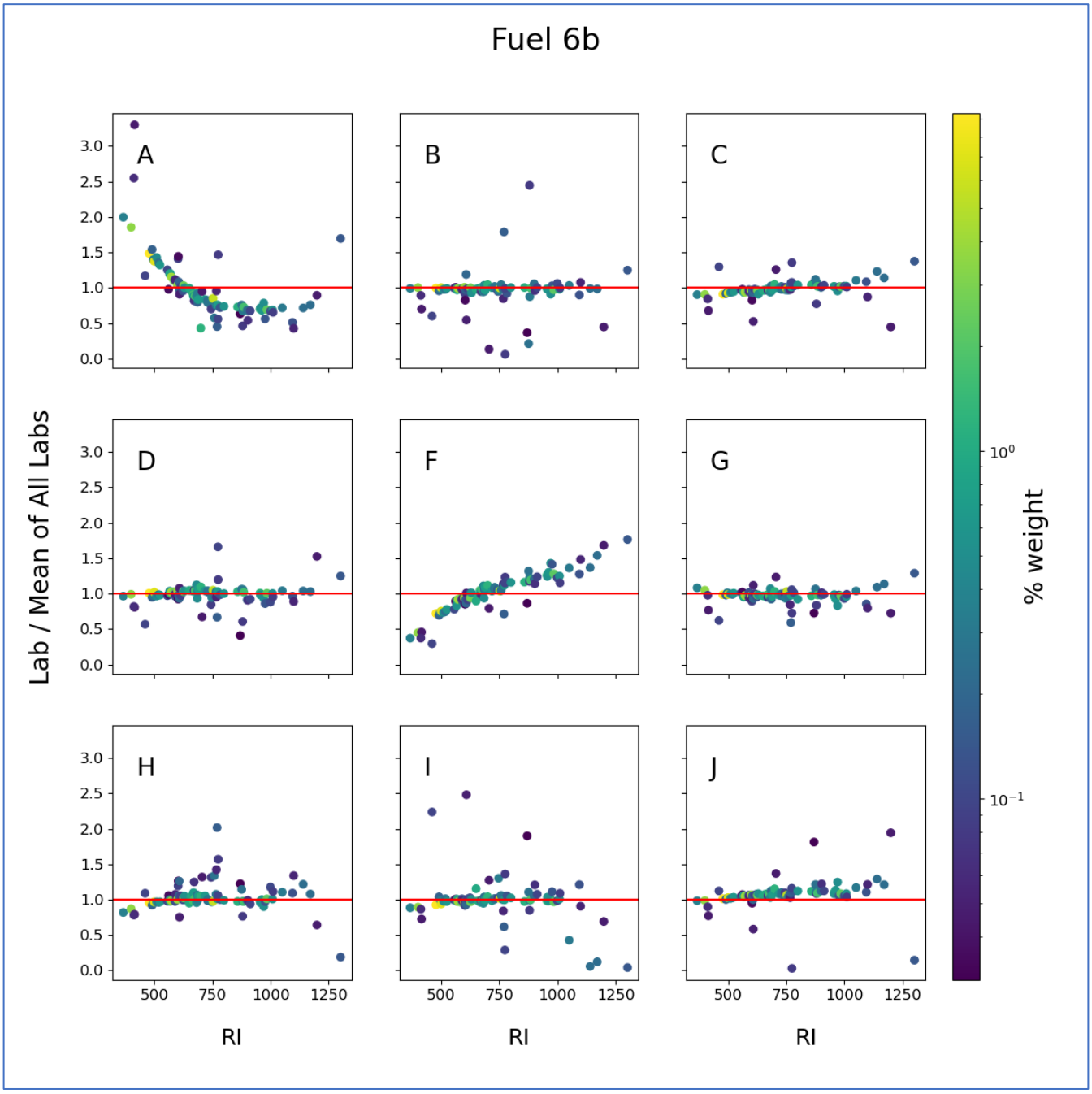
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-7

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 6b

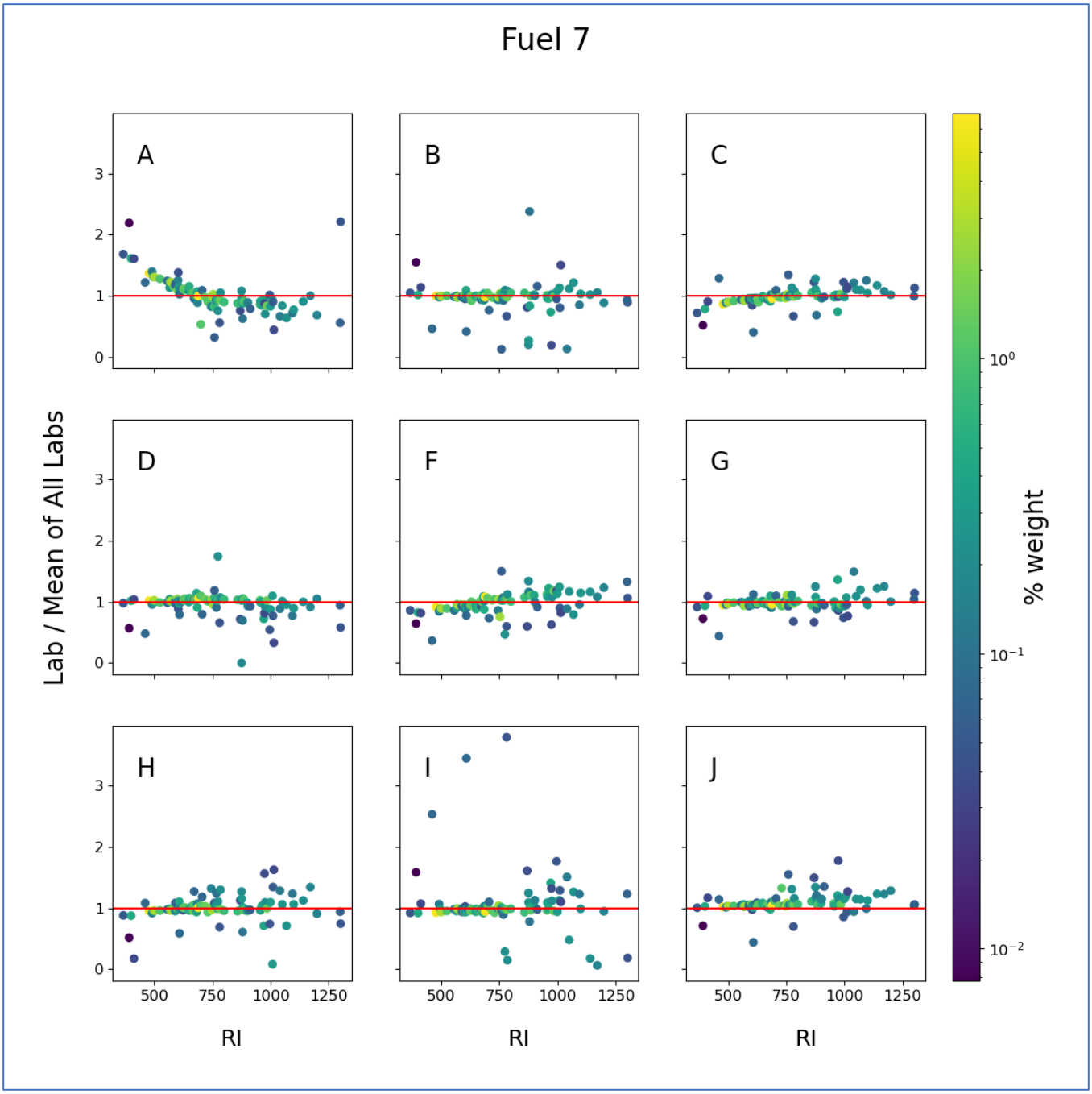
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-8

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) for Each Named Compound in Fuel 7

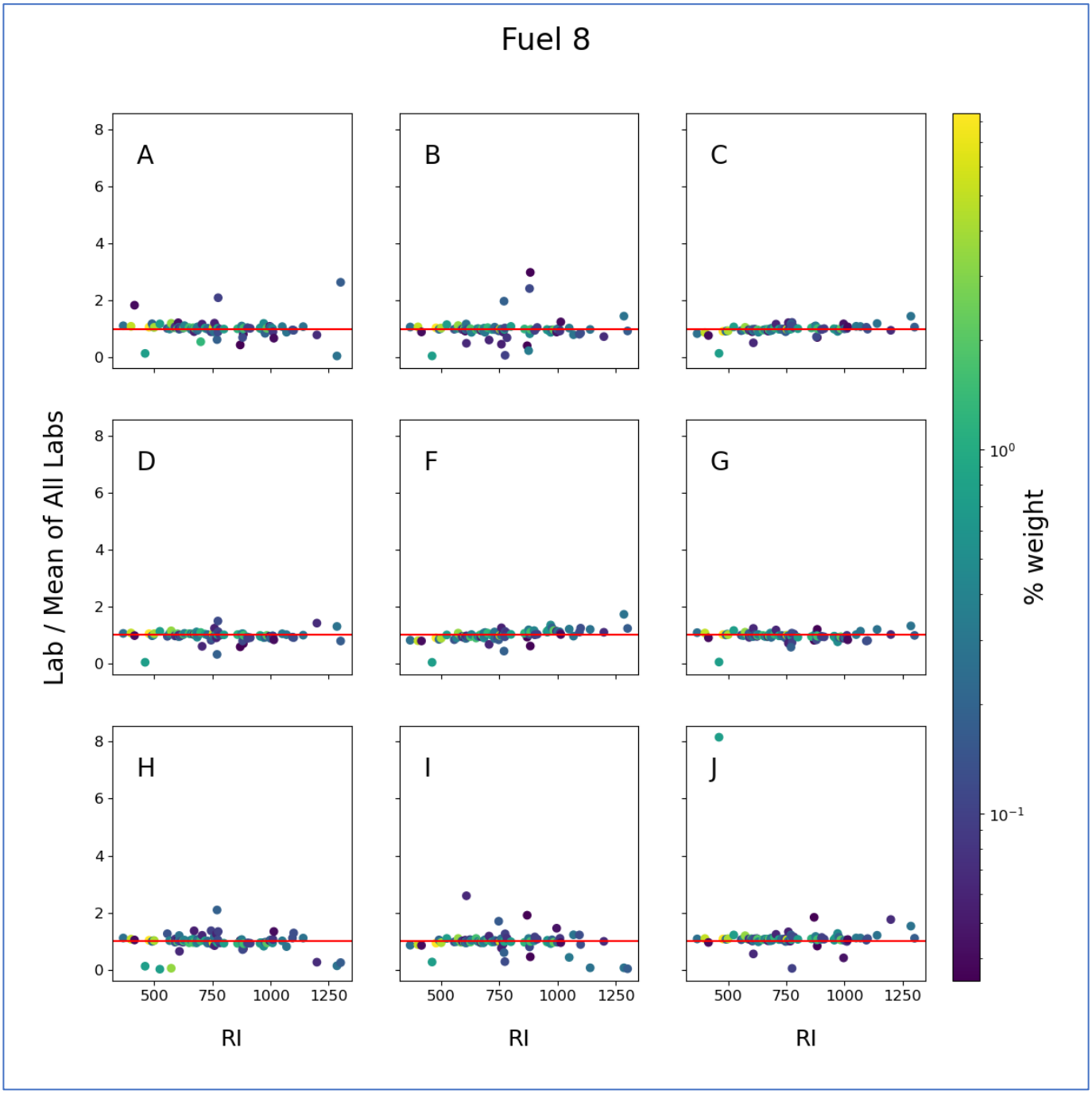
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix VIII-9

Comparison of Individual Lab Wt.% Results with Mean Wt.% Results from All Labs (Excluding Lab E) or Each Named Compound in Fuel 8

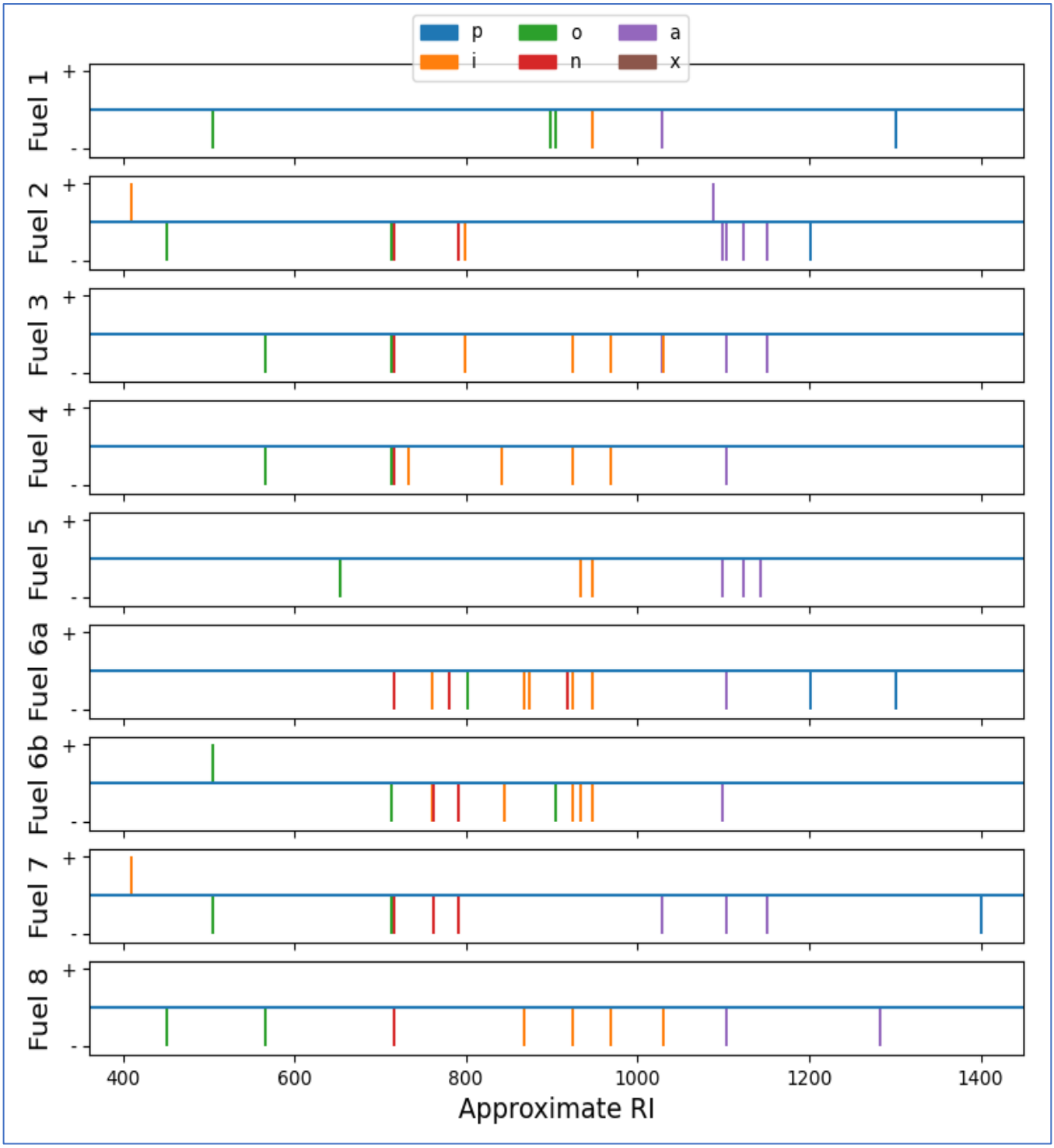
Compounds are ordered along the x-axis by retention index (RI)
Laboratory is identified by the letter shown in each panel
Red horizontal line indicates mean of all labs
Coloring of data points indicates wt.% value for each named compound



Appendix X-1

Individual Compound Wt.% Results from Lab A Showing Large Deviations from the Mean

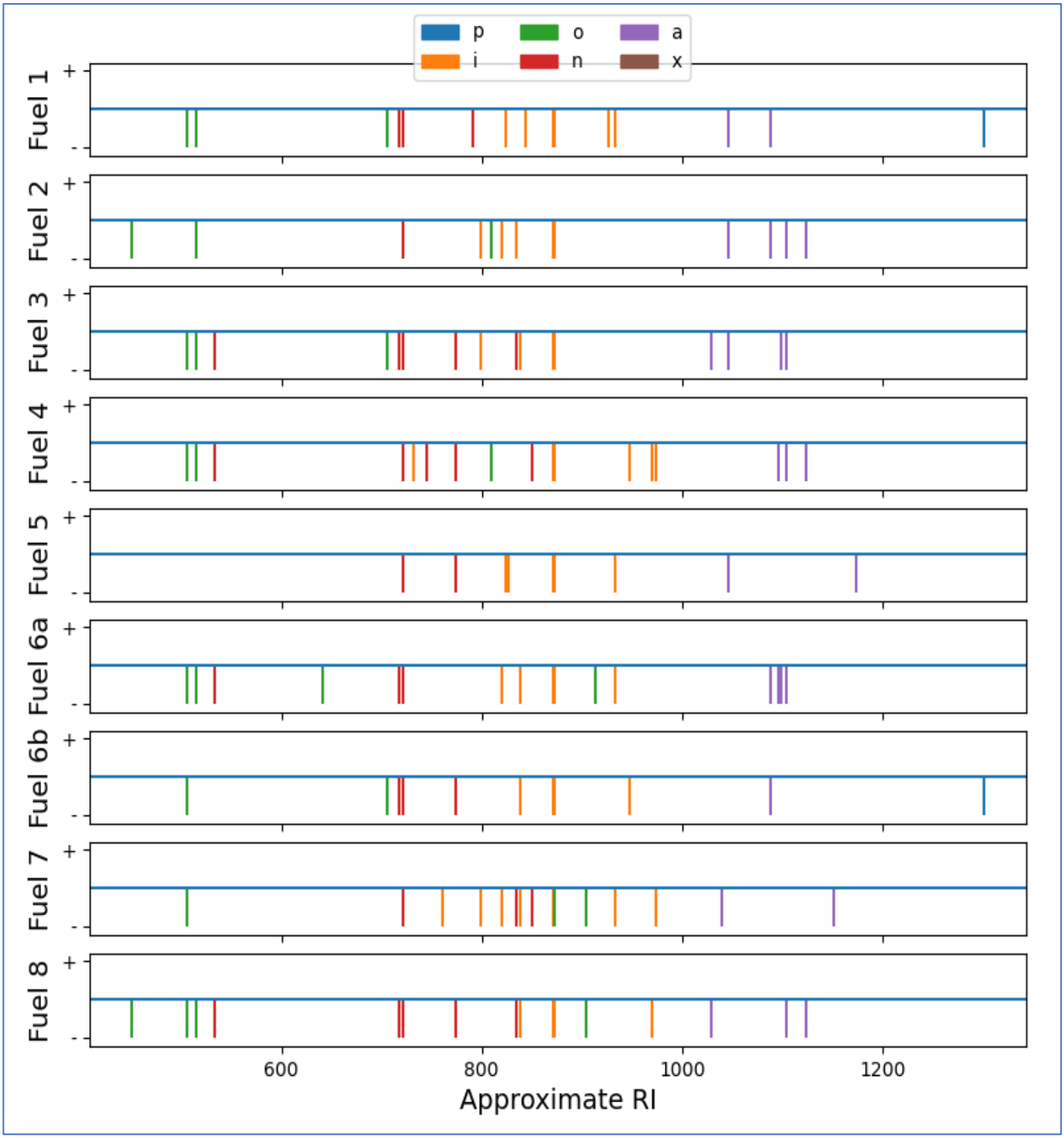
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-2

Individual Compound Wt.% Results from Lab B Showing Large Deviations from the Mean

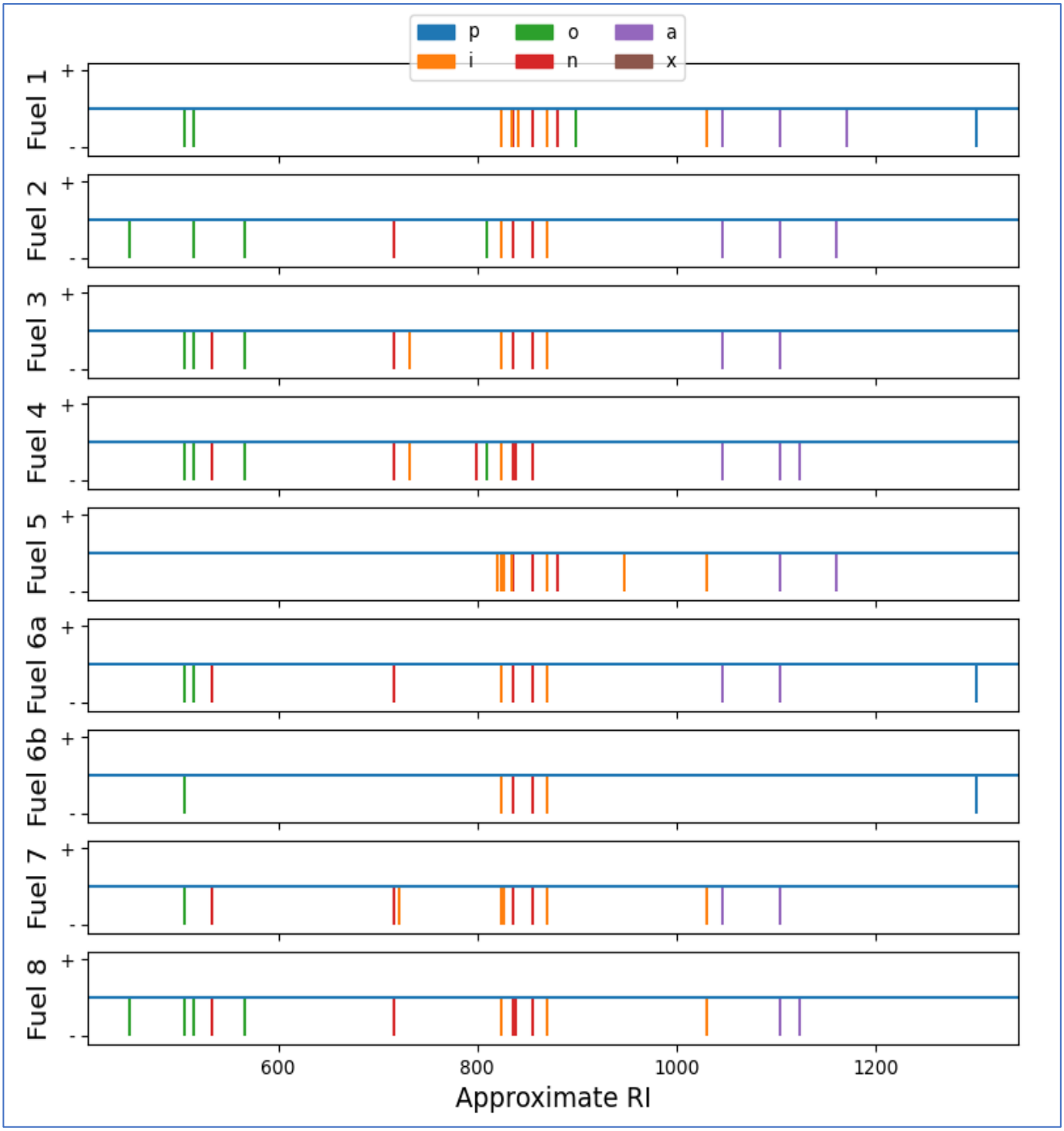
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-3

Individual Compound Wt.% Results from Lab C Showing Large Deviations from the Mean

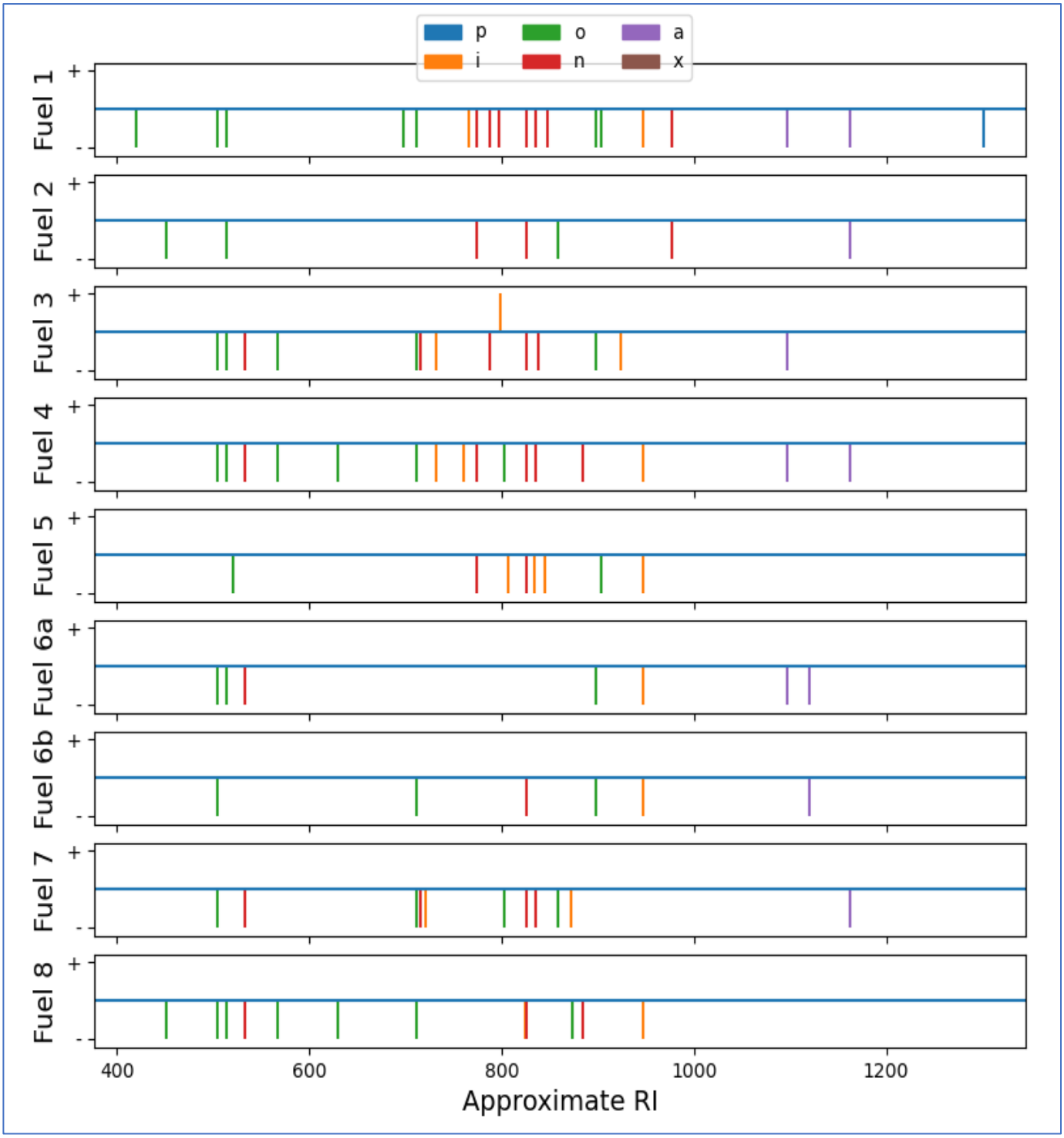
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-4

Individual Compound Wt.% Results from Lab D Showing Large Deviations from the Mean

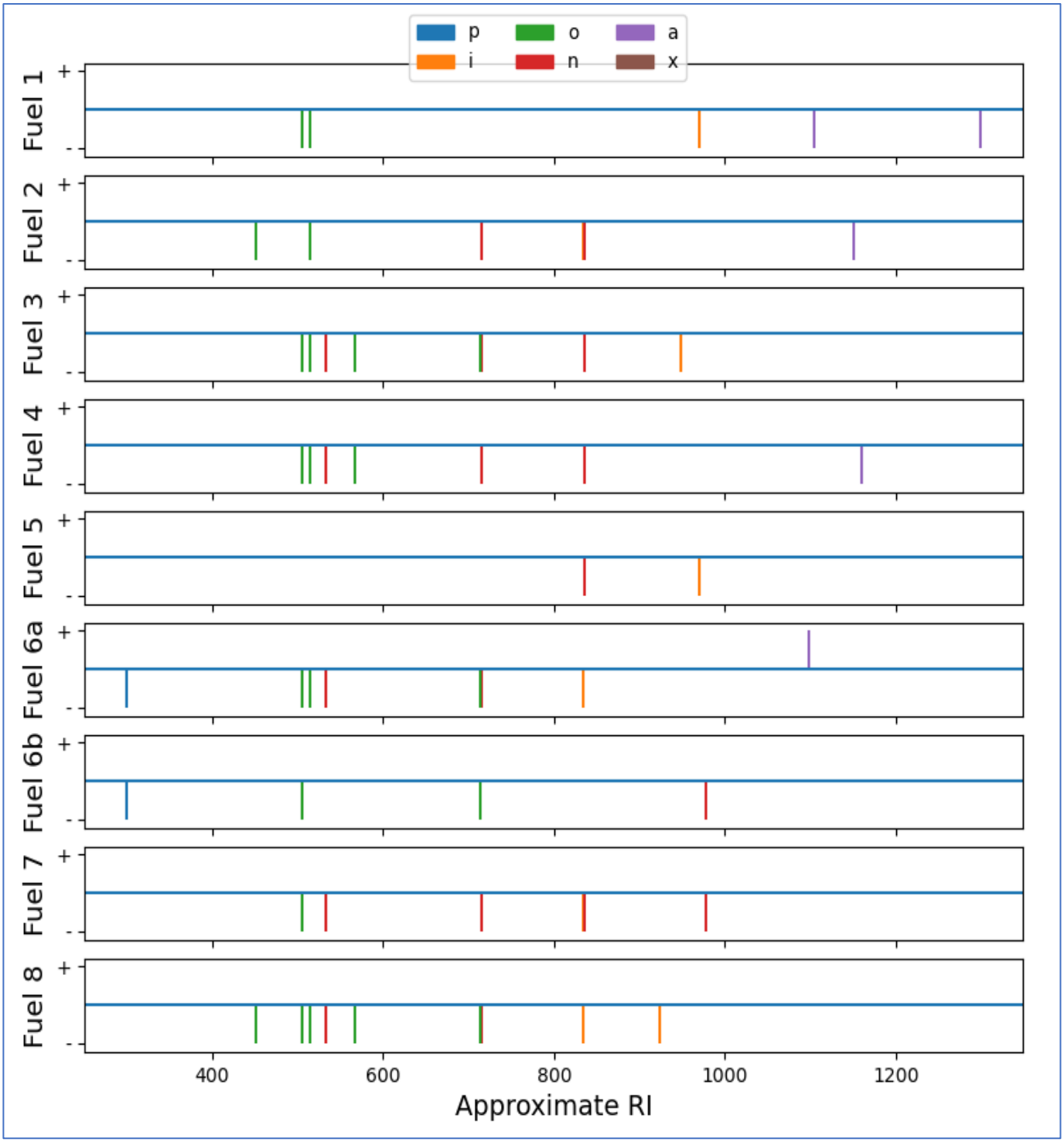
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-5

Individual Compound Wt.% Results from Lab F Showing Large Deviations from the Mean

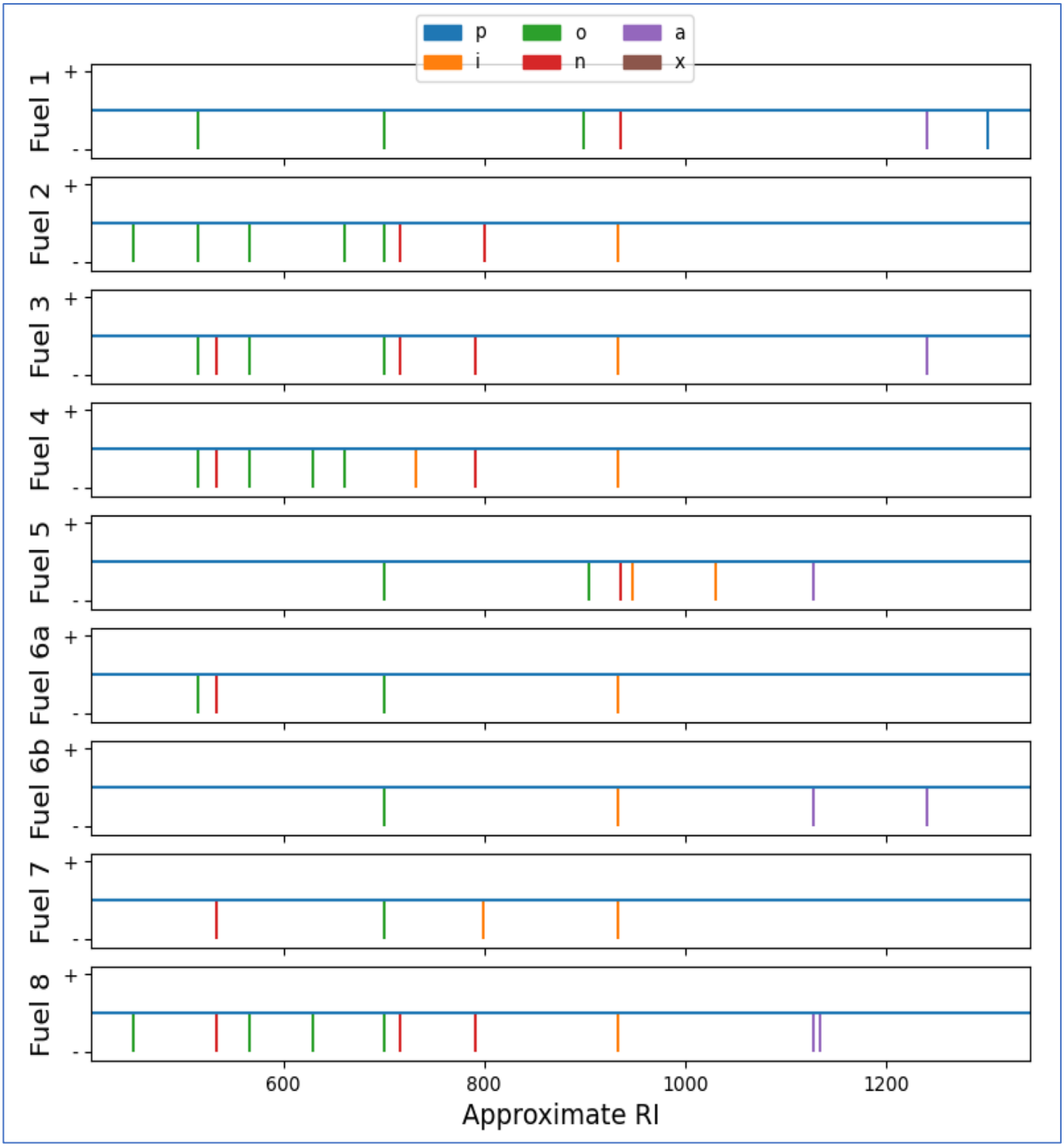
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-6

Individual Compound Wt.% Results from Lab G Showing Large Deviations from the Mean

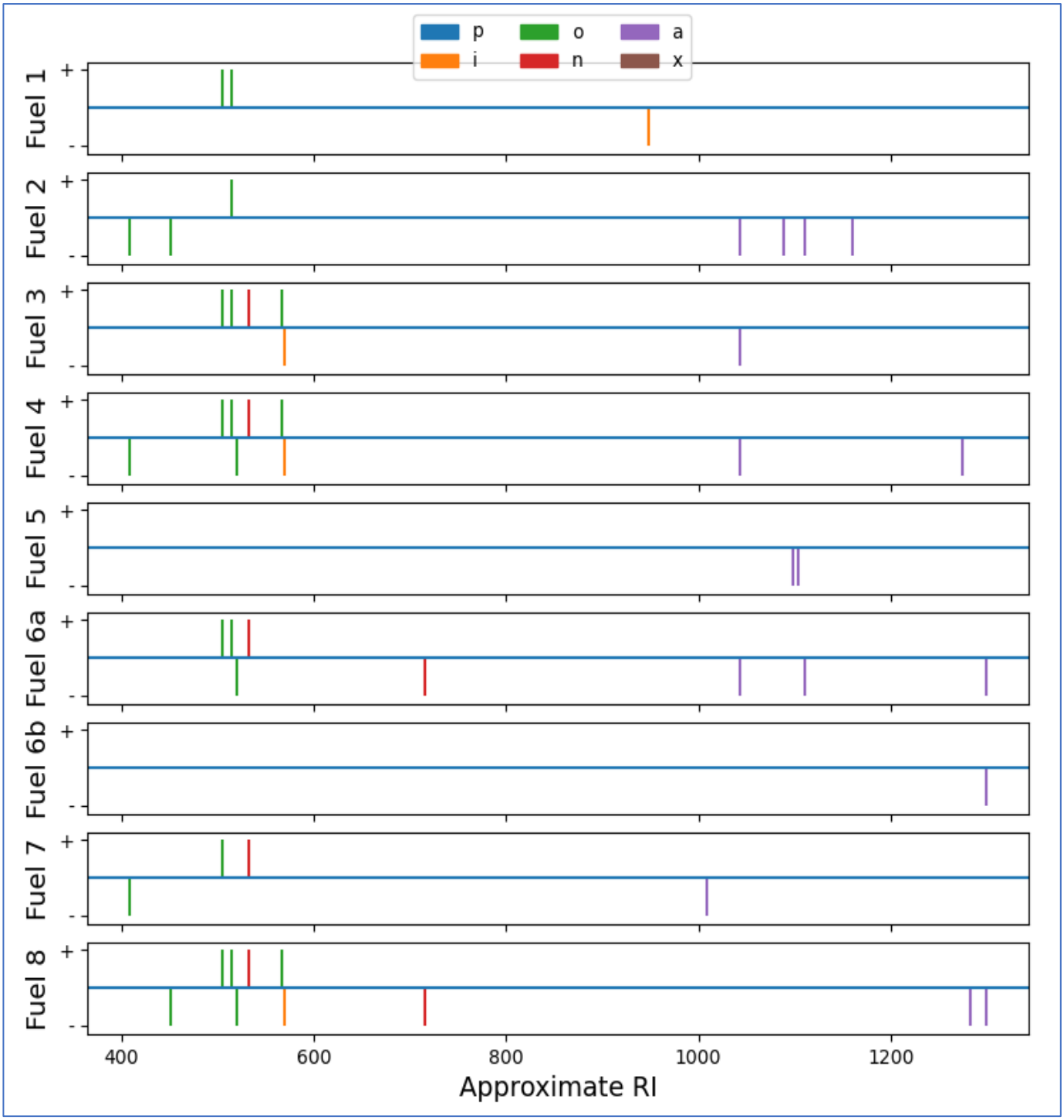
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-7

Individual Compound Wt.% Results from Lab H Showing Large Deviations from the Mean

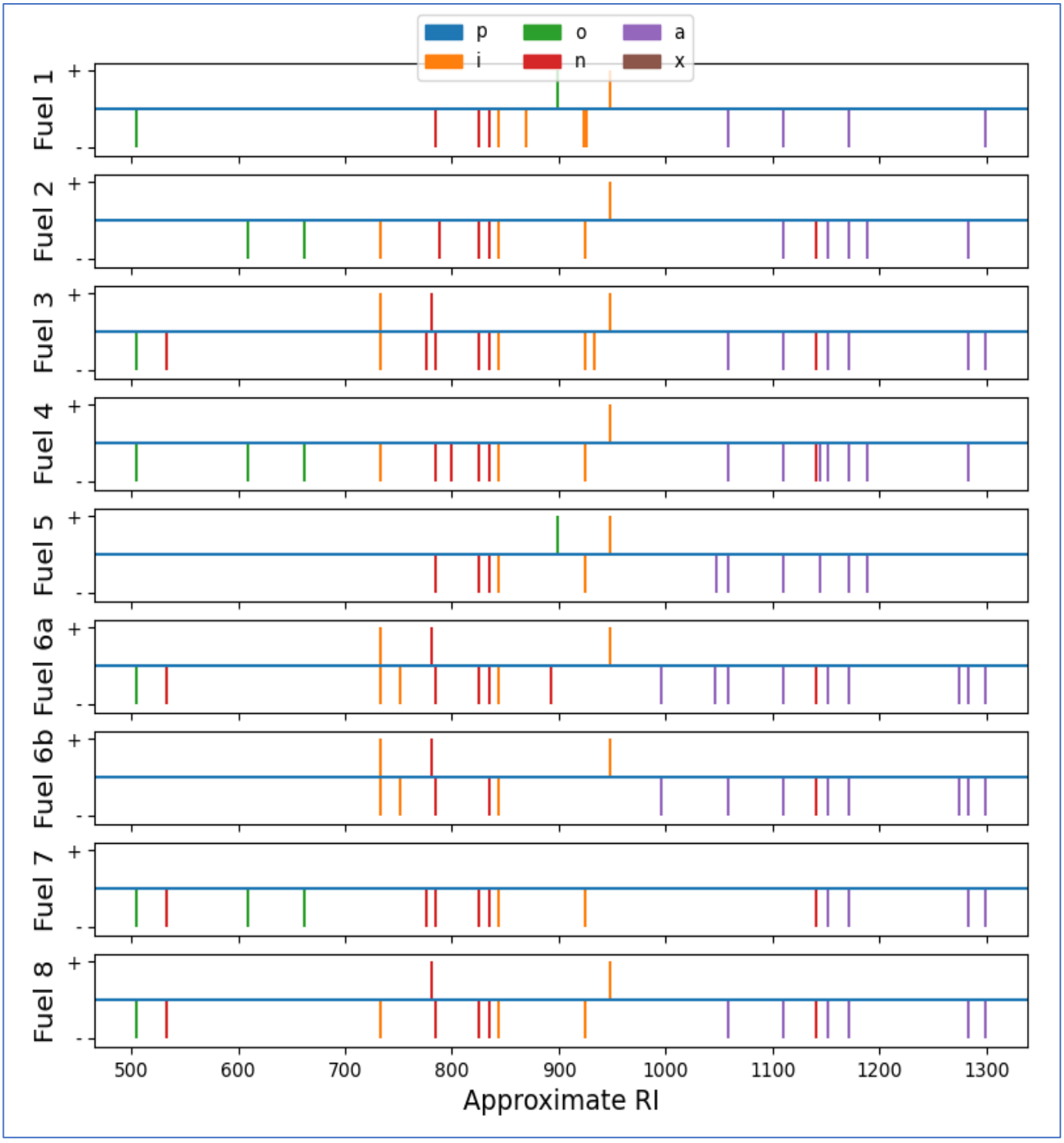
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-8

Individual Compound Wt.% Results from Lab I Showing Large Deviations from the Mean

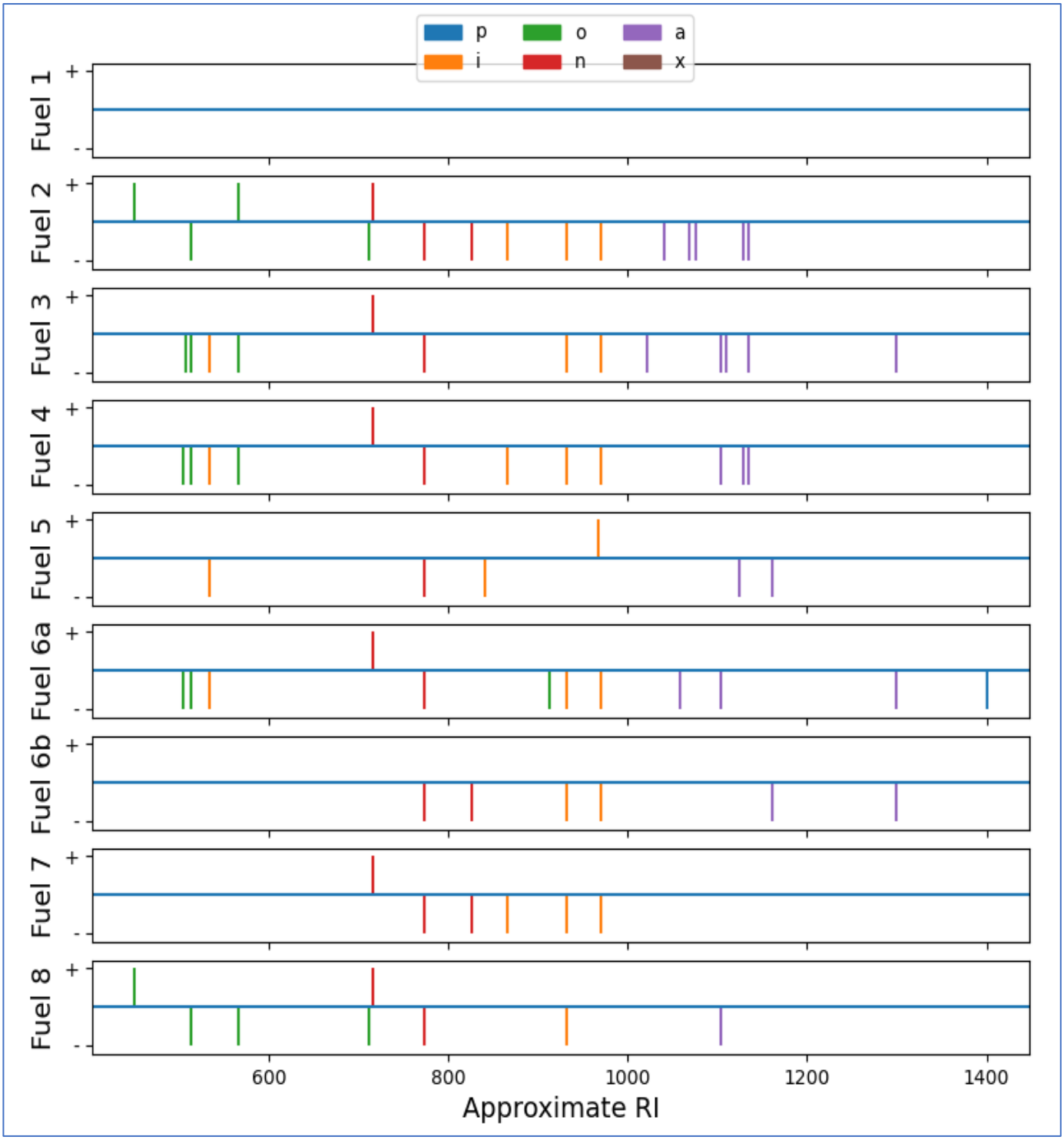
Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix X-9

Individual Compound Wt.% Results from Lab J Showing Large Deviations from the Mean

Mean result for individual compound is calculated only if 5 or more labs reported a value
Positive and negative tick marks indicate compounds differing from mean by a factor of 4 or more
X-axis indicates approximate retention index (RI)



Appendix XI

Responses from the Participating Laboratories

General Questions asked of all Laboratories

1. What sort of QC was performed on the DHA results? (e.g., baseline adjustments and peak identification checks)

   Lab A: A naphtha SQC was tested with a history on a different analyzer. It is tracked for total by group type. Some differences were to be expected between analyzers. The sample did not have enough isopentane to make the discrimination obvious. SQC practices have been amended to include additional checks after major overhauls. Unfortunately, we do not have retains of the AVFL material to retest.

   Lab B: Typical data analysis procedure described in question 13 of the attachment, with additional information about our check standard in the "Additional Comment" at the bottom of the document

   Lab C: The sample chromatograms are overlaid and compared with a lab base fuel, as well as each other. This is done to identify any significant baseline or retention time shifts caused by system instability during the GC analysis of the samples. These shifts are normally attributed to an uneven temperature ramp cause by dropping CO_2 levels. If it is determined a sample was effected by system instability, the GC analysis is repeated before post-run adjustments begin. The post-run adjustments made to the chromatogram consist of manual baseline adjustments, manual peak splitting, and integration corrections. This is done before the chromatogram is processed using Dragon DHA, for peak identification. Dragon DHA is then used to auto ID the components. Peak identifications are then verified or adjusted based on the reference standard chromatogram and software library.

   Lab D: A PIONA standard is run to verify the RT of the compounds. MS I also used to verify identification

   Lab G: Manual integration (splits, baseline adjustments, etc) and peak ID checks were performed on all samples

2. What was the threshold setting for the peak identification/integration algorithm?

   Lab A: Slope sensitivity was 0.8.

   Lab B: We chose a point in the middle of the chromatogram where there are no peaks and set the integration threshold for the baseline at that level.

   Lab C: The integration events thresholds normally used to process a sample's chromatogram in Chemstation are listed in the table below. The only variable that may be adjusted from one sample to the next is the Slope Sensitivity at 46.00 minutes. This value is adjusted to

provide a smooth consistent baseline that does not include excess area below a peak's baseline, from the 46.00 minute mark until the end of the run. This is done to prevent inflated area amounts from being reported for the normally small peaks beyond n-C_{12}.

Event	Value	Time
Initial Slope Sensitivity	1.000	Initial
Initial Peak Width	0.100	Initial
Initial Area Reject	0.000	Initial
Initial Height Reject	0.000	Initial
Initial Shoulders	OFF	Initial
Slope Sensitivity	0.050	46.000
Auto Peak Width		46.000

Lab D: Each run is looked at the baseline noise. Looking for peaks above noise.

Lab G: We try to identify as many peaks as possible that are integrated. It is a combination of what peaks are available in our database and decisions based on the knowledge of the stream.

Method Manual Events ☐

Initial Events For All Signals:

Integration Events	Value
Tangent Skim Mode	Standard
Tail Peak Skim Height Ratio	0.00
Front Peak Skim Height Ratio	0.00
Skim Valley Ratio	20.00
Baseline Correction	Classical
Peak to Valley Ratio	500.00

Specific Events For Signal:

FID Default

Time	Integration Events	Value
Initial	Slope Sensitivity	0.3
Initial	Peak Width	0.034
Initial	Area Reject	0.05
Initial	Height Reject	0.001
Initial	Shoulders	OFF
0.000	Integration	OFF
1.500	Integration	ON
45.000	Area Reject	0.12

3. When the samples arrived, were there any signs of leakage, such as a strong gasoline odor when the inner bag was opened?

   Lab A: None was noted

   Lab B: No.

   Lab C: The samples arrived in good condition and did not show signs of leakage.

   Lab D: Yes the was an odor and one bottle cap was broken

   Lab G: I cannot answer this for when the samples arrive to AL. When the samples arrived in Analytical there was no odor.

4. Did the samples remain cold from shipping → storage → sampling → injection? What effect, if any, might sample handling have had on loss of gasoline light ends?

   Lab A: Samples were stored in the refrigerator, but the injector tray was not chilled. No harm identified as results were typically high on the front end.

   Lab B: Minimal. Samples were unpacked and put into cold storage until ready to run. Then they were pulled out, mixed (end-over-end), opened, and sample was aliquoted for immediate analysis.

   Lab C: Because the shipping and handling process took place outside the controls of our facilities, it cannot be determined if the samples remained cold in that time period. However, we can speculate the samples likely did not remain cold since they were received during the summer. Once the samples were received in our facilities and logged into our system, they were placed in cold storage. The sampling from the containers received into the GC vials took place in the cold storage environment. All items used in the sampling process pipets, GC vial, vial cap, vial tray, technician, and crimpers were chilled in the cold storage environment before sampling was performed. The prepared GC vials were then moved to the instrument's auto sampler, where the samples were allowed to reach ambient temperatures while waiting to be injected. The effect of sample handling on the loss of light end components can be significant but circumstantial and debatable as well. Depending on the responses to the samples remaining cold during the handling process, the data may support the loss of components in the C_1-C_3 range. The results found in Appendix III indicate some labs were not able to identify components in the C_1-C_3 range consistently, which may have been caused by the loss of those light ends.

   Lab D: Sample may have been on the facility dock until delivered to the building. After they arrive they are storge in a refrigerator

   Lab G: Samples once they were received in analytical were stored cold until they were placed into a sealed GC vial. Vials are not chilled on the instrument. If sample bottles were opened prior to chilling, this would impact light end loss, but since we in AS didn't have fully custody of the samples, I cannot speak to what was done prior to our receipt.

5. Address the instances in the report in which your lab results were called out as an outlier. Pages 18- 20, 39 and Appendix III are good starting points to check for outliers. A more thorough review can be performed by running a search on your lab's designation in the report. Are you aware of possible reasons that may explain outliers associated with your lab results?

   Lab A:

   - The methylnaphthalenes were incorrectly entered into the new template, one defined as a C_{10} aromatic and one defined as a C_{12} aromatic.
   - I'm not sure what kind of adjustment went into the data set. The total naphthenes and total olefins don't match what we reported. It looks like the naphtheno-olefin values may have been added into the naphthenes, but that isn't a complete explanation for the differences. (If it says in the report, I can't find it. The report is locked so I can't search.) Anyhow, we can't always tell the difference between a diolefin and a naphtheno-olefin by mass spectrometer (m/z 81), so it is possible those identities are interchanged.
   - The report says we are low on an olefin in the RI region of 710 for 6 of 9 fuels. Every compound in that region was identified as an olefin. One is labeled as a naptheno-olefin, 2 which may be the discrepancy. (FWIW, I would always consider the olefin function to trump naphthene: they suck up hydrogen in a hydrotreater, they cause gums, and they have an elevated blending RON in octane calculations.)

   Lab B: We got called out for 2,6- dimethylheptene-1 which is present at less than 0.1 wt% in all samples. Our DHA library was not designed with an emphasis on olefins in the C9+ region. Therefore, due to the fact that we lack mass spec data for these DHA runs, the compound identification was made solely based on retention index (785) – which after investigation, appears to be wrong in our library. The KOVATS retention index for this compound is around 840-860, in the Enhanced DHA Method (AVFL-29) SSI had a retention index of 882. I think our retention index may have been set incorrectly, which can happen if the compound is never actually confirmed by GC/MS or in a standard.

   Lab C: The C_{12} olefin PMI contribution outlier for Fuel 3 found in Appendix IV, may be caused by a lack of identifiable components in the reference library. The addition of the ASTM D6730 expanded X1.2 table components to the reference library, as well as the use of a FID+MS setup may correct this. This reasoning is supported by the data indicating 2 of the 3 labs without an outlier result for this metric, reported the use of the extended method coupled with a FID+MS.

   Lab D: Hydrocarbon expert can change manual Identified compounds if you click on a id flag and reassign it back to the wrong compound. This occurs for overloaded compounds where the RT changes.

   Lab G:

- Sample 1 – C#11 olefins were marked as an outlier. Total reported was 0.044 compared to a mean of 0.022. This could be the difference of one small peak and we would not consider this difference of significance in DHA.
- Sample 2 – C#10 naphthenes are marked as outlier. Total reported was 0.088 compared to mean of 0.369. It appears that the C#9 naphthene content reported was higher than the average (1.318 vs 1.104) so it is possible that we are naming these peaks C9s instead of C10s. For heavy naphthenes, there are many coelutions and it would be impossible to distinguish, especially at this low concentration.
- Sample 3 – C#13 aromatics was marked as outlier. Total reported was 0.125 compared to mean of 0.063 (it should be noted that only 3 labs reported any C#13 aromatics). This outlier is likely due to the fact that we are naming heavier aromatic species than other labs.
- Sample 4 – C#10 napthenes were marked as outlier. Total reported was 0.065 compared to mean of 0.32. No C#9 naphthene difference is seen in this sample so these peaks must have been named other species. This would still not be considered a difference of significance in DHA.
- Sample 5, 6, and 7. No outliers.
- Sample 8 – C#13 aromatics were marked as outlier. Total reported was 0.099 compared to mean of 0.03. See note on sample 3. This would also not be considered a significant difference in DHA.
- Sample 9 - C#10 naphthenes are marked as outlier. Total reported was 0.077 compared to mean of 0.349. See notes on sample 2 and 4.

None of the differences in any of the samples would be concerning from a general DHA standpoint in normal analyses and most of these differences are too small to practically troubleshoot. DHA is notoriously difficult in the heavier regions past C#9, and so it is not surprising that there is variation in this region.

6. As discussed on draft final report p.34, it appears ethanol may have been mistakenly attributed to other compounds in some cases. Was ethanol mistakenly attributed to other compounds for your lab results?

   Lab A: Yes, this could have occurred as the software does not tangent-skim.

   Lab B: No – we split ethanol / 3-methylbutene regularly.

   Lab C: The bulk of the ethanol in the test samples was identified correctly as ethanol. The data supports this as the reported results fall in with ratio to mean lines on page 35, for every sample. However the data does indicate there is some contribution to the 3-methylbutene-1 from the ethanol. This is likely caused by ethanol's tendency to tail, underrunning components in the immediate area.

   Lab D: No

   Lab G: No. Ethanol was only named in samples where it was confirmed by D4815.

7. It would be very helpful if the original questionnaire could be reviewed for accuracy and completeness.

   Lab A: No comment

   Lab B: Reviewed – attached a revised version with more information disclosed. See comments.

   Lab C: The responses to the original questionnaire were reviewed and determined to be complete

   Lab D: Using hydrocarbon Expert v 5.34

   Lab G: Based on the table in the report, I have updated the questionnaire (attached) to provide some information without revealing proprietary methodology

8. Any additional comments or clarifications regarding your lab's results would be welcome.

   Lab A: No comment

   Lab B: None at this time.

   Lab C: No comments.

   Lab D: No comments.

   Lab G: understand the conclusions of the study, but I think that the difficulty of analyzing compounds in the C_{10}-C_{12} region of DHA is underemphasized. DHA has significantly decreased resolving power in this region and there are also an exponential number of naphthene, isoparaffins, and olefin isomers that can interfere and coelute. It can quickly become difficult to distinguish between these species and the heavy aromatics that are seen to cause significant differences in PMI. If heavier aromatics are the major contributor to PMI, I wonder if some type of 2D GC method that has the ability to separate heavy aromatics from the other species might give a more accurate representation than DHA. Working to standardize these peaks would be a very difficult task give the method differences and even column to column differences seen in DHA

Specific Questions asked of individual Laboratories

Lab A: Results from several fuels showed an apparent volatility bias whereby light components are over-estimated and heavy components are under-estimated compared to the mean results from all labs. (This can be seen from figures in Appendix VII.) Are you aware of an explanation for this?

Response: These samples were tested on a new installation. Investigation determined that the incorrect liner (splitless instead of split) was installed, which caused discrimination.