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Dramatic increase in reactive volatile organic compound (VOC) emissions from ships at berth after implementing the fuel switch policy in the Pearl River Delta Emission Control Area

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Table S1. More information during sampling.

NO	Sampling temperature (℃)	Auxiliary engine				
		Power（kW）	Amount	Condition	Engine loads (%)	Fuel consumption rate($t*d^{-1}$)
Coastal vessels (before IFSP)						
A	17	1760	2	Off	-	-
		1320	1	On	53	3.0
B	32	2045	2	Off	-	-
		2045	1	On	40	4.1
C-1	34	1760	2	Off	-	-
		1320	1	On	55	4.0
D-1	29	660	1	Off	-	-
		660	2	On	34	2.2
Coastal vessels (after IFSP)						
E	25	200	1	Off	-	-
		200	1	On	39	0.4
F	21	200	2	Off	-	-
		200	1	On	50	0.5
C-2	29	1760	2	Off	-	-
		1320	1	On	52	3.5
G	31	500	2	Off	-	-
		500	1	On	65	1.8
D-2	31	660	1	Off	-	-
		660	2	On	37	2.4
River vessels						
H	25	76	1	Off	-	-
		144	1	Off	-	-
		144	1	On	40	0.3
I	32	73.5	2	On	40	0.3
J	38	58	1	Off	-	-
		58	1	On	32	0.1
K	35	58.8	1	Off	-	-
		58.8	1	On	35	0.1

Table S2. The percentage of the top 25 VOC species in EFs.

Species (before IFSP)	Coastal vessels Mean ± 95% C.I.	Species (after IFSP)	Coastal vessels Mean ± 95% C.I.	Species	River vessels Mean ± 95% C.I.
n-Hexane	0.67 ± 0.25	Ethane	1.16 ± 0.50	Ethane	0.94 ± 0.30
n-Octane	0.60 ± 0.15	Propane	0.81 ± 0.39	n-Butane	1.18 ± 2.25
n-Nonane	2.74 ± 1.65	n-Butane	2.59 ± 2.89	n-Octane	0.60 ± 0.27
n-Decane	7.40 ± 6.48	n-Pentane	0.61 ± 0.61	n-Nonane	2.57 ± 1.12
n-Undecane	16.20 ± 10.34	n-Nonane	2.37 ± 2.57	n-Decane	4.15 ± 1.95
n-Dodecane	15.78 ± 9.90	n-Decane	6.27 ± 6.87	n-Undecane	2.93 ± 1.38
Isopentane	1.61 ± 0.69	n-Undecane	2.61 ± 2.92	Isobutane	15.99 ± 5.25
3-Methylhexane	0.79 ± 0.41	n-Dodecane	2.90 ± 5.59	Isopentane	1.96 ± 0.51
TM224PE[a]	2.30 ± 1.16	Isobutane	8.47 ± 3.68	3-Methylhexane	0.61 ± 0.20
Ethylene	2.85 ± 1.50	Isopentane	1.65 ± 0.82	TM224PE[a]	0.82 ± 0.24
Propene	5.36 ± 2.34	Ethylene	23.88 ± 11.66	Ethylene	23.85 ± 7.17
1-Butene	1.90 ± 1.11	Propene	10.89 ± 2.94	Propene	12.38 ± 3.51
Trans-2-butene	0.51 ± 0.26	1-Butene	2.64 ± 0.69	1-Butene	2.30 ± 0.17
1-Pentene	2.66 ± 1.83	1-Pentene	1.63 ± 0.40	1-Pentene	1.90 ± 0.17
1-Hexene	5.88 ± 5.01	1-Hexene	1.09 ± 0.37	1-Hexene	1.58 ± 0.31
M4PE1ENE[b]	0.64 ± 0.38	Acetylene	7.87 ± 10.50	Acetylene	6.90 ± 2.99
Acetylene	0.85 ± 0.55	Benzene	3.82 ± 2.92	Benzene	3.04 ± 0.32
Benzene	13.24 ± 11.47	Toluene	2.10 ± 1.28	Toluene	1.74 ± 0.18
Toluene	5.91 ± 2.92	Ethylbenzene	0.67 ± 0.31	Ethylbenzene	0.66 ± 0.25
Ethylbenzene	1.29 ± 0.27	m/p-Xylene	1.93 ± 1.03	m/p-Xylene	1.34 ± 0.59
m/p-Xylene	1.80 ± 0.25	o-Xylene	0.97 ± 0.55	o-Xylene	0.73 ± 0.31
o-Xylene	0.70 ± 0.12	m-Ethyltoluene	1.09 ± 0.99	m-Ethyltoluene	1.27 ± 0.68
m-Ethyltoluene	0.54 ± 0.21	o-Ethyltoluene	0.68 ± 0.64	o-Ethyltoluene	0.60 ± 0.25
TM123B[c]	0.91 ± 0.38	TM123B	0.86 ± 0.82	TM123B	0.81 ± 0.41
TM124B[d]	1.47 ± 1.05	TM124B	1.79 ± 1.79	TM124B	1.94 ± 0.84

[a]2,2,4-Trimethylpentane; [b]4-Methyl-1-pentene; [c]1,2,3-Trimethylbenzene; [d]1,2,4-Trimethylbenzene.

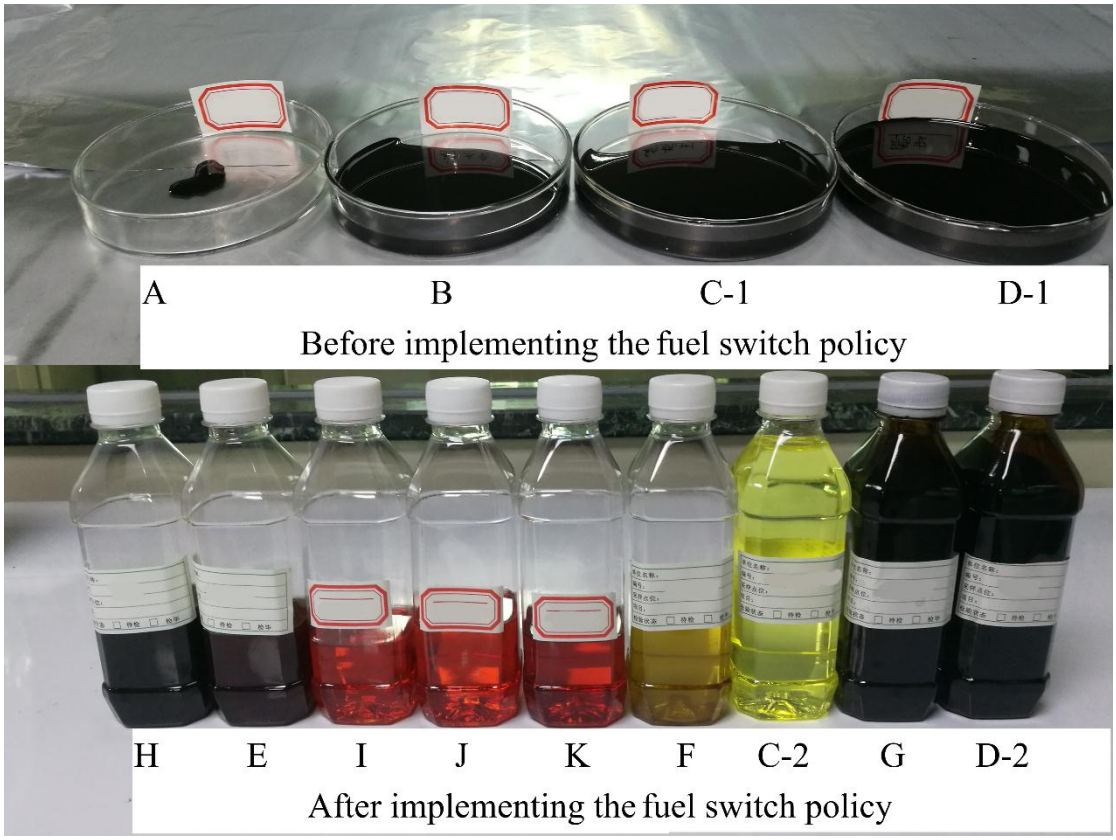

Figure S1. The fuels used by ship at berth.

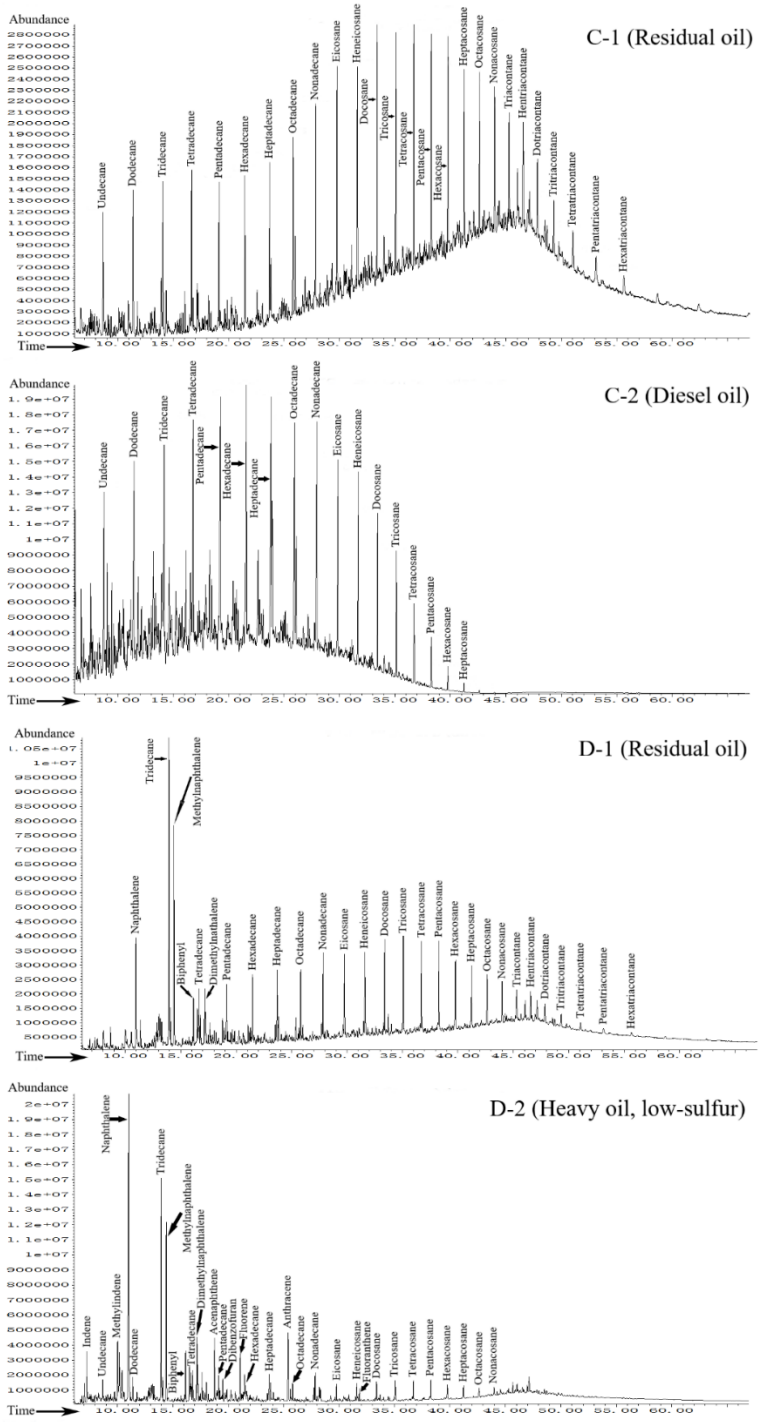

Figure S2. Typical total ion chromatographs of VOC species in fuel oils.

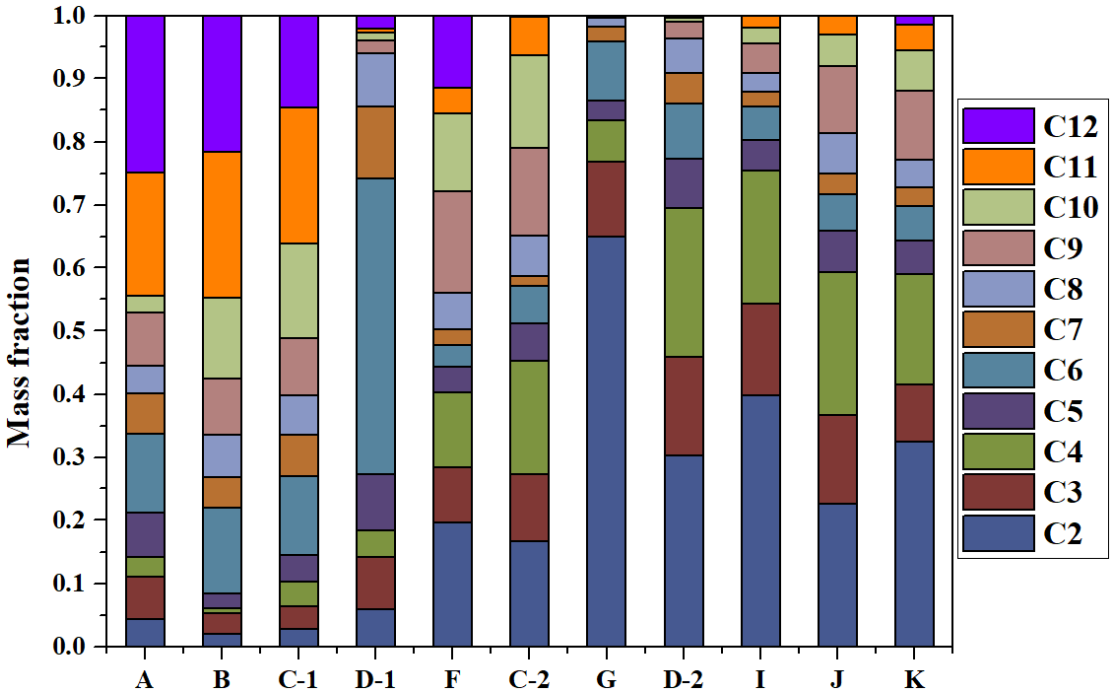

Figure S3. VOCs grouping according to their carbon numbers.

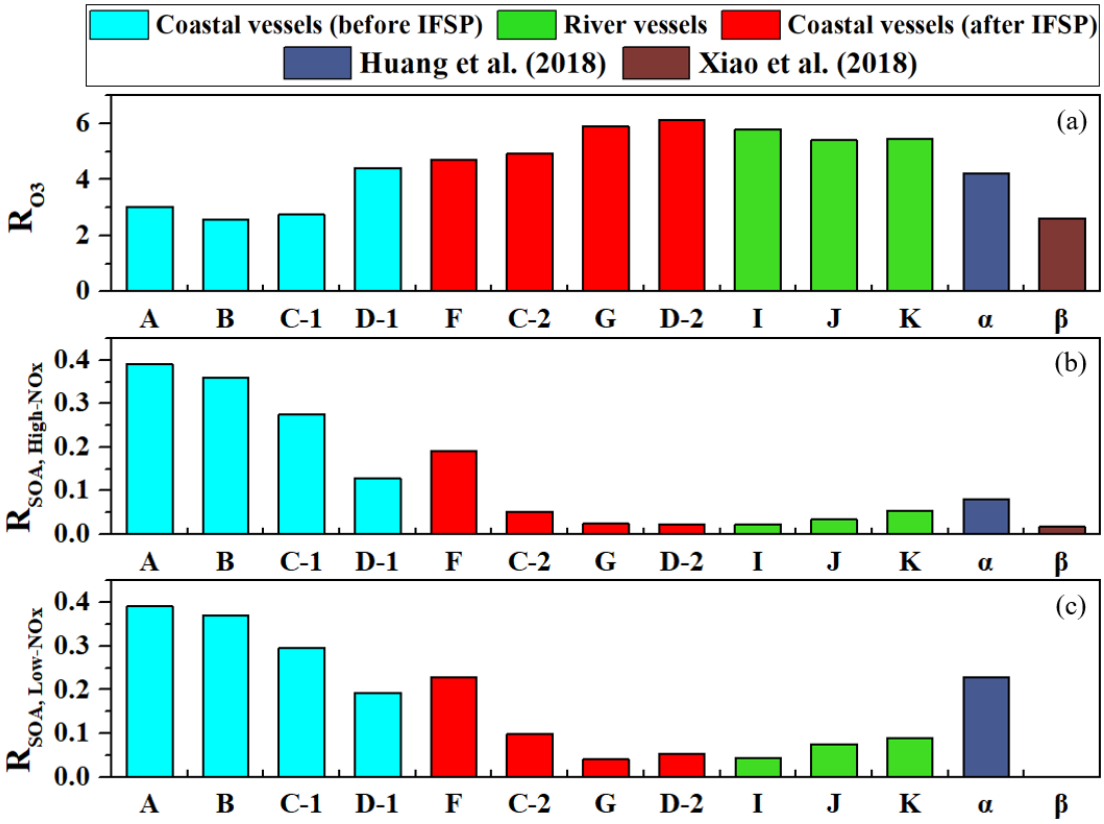

Figure S4. Comparison of R_{O3} (g O_3 g^{-1} VOCs) and R_{SOA} (g SOA g^{-1} VOCs) based on VOCs source profiles with calculated results from previous studies.

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