IMPACT OF LOW-EMISSION DIESEL ENGINES ON UNDERGROUND MINE AIR QUALITY

APPENDICES TO THE FINAL REPORT

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APPENDIX A. LEAKY FILTER DILUTOR

The TSI 3020 CPC has a maximum concentration of 500,000 particles/cm^3. For this reason, a dilutor was necessary to reduce the exhaust aerosol concentration to within operating limits of the CPC. The leaky-filter dilutor design was chosen because of its repeatable dilution and simple design. The leaky filter dilutor works passively and is therefore dependent upon the flow rate generated by the measurement instrument. A glass capillary tube was placed inside a capsule filter (No. 12144, Pall-Gelman Laboratory) to create a leak through the filter. The diameter of the capillary tube determines the dilution ratio. Figure A-1 is a schematic diagram of a leaky filter dilutor.

The dilution ratio, D_r, is defined as

$$D_r = \frac{C_0}{C_{dil}}, \tag{0.1}$$

where C_0 and C_{dil} are the initial and diluted concentrations, respectively. The diluted concentration is defined as

$$C_{Dil} = \frac{C_0 Q_{cap} + C_{fil} Q_{fil}}{Q_{inst}}, \tag{0.2}$$

where C_{fil} is the filtered concentration, Q_{cap} is the capillary aerosol flow rate, Q_{fil} is the filtered aerosol flow rate, and Q_{inst} is the measurement instrument flow rate. Since the filtered aerosol concentration is essentially zero, $C_{fil} = 0$, we have

$$C_{Dil} = C_0 \frac{Q_{cap}}{Q_{inst}}. \tag{0.3}$$

Substituting C_{dil} into (0.1), the final dilution ratio is

$$D_r = \frac{Q_{inst}}{Q_{cap}}. \tag{0.4}$$

The pressure vs. flow relationship of the capsule filter was measured. The results were approximated by a linear regression to obtain an empirical relation for the filter pressure vs. flow such that

$$\Delta p_{fil} = m Q_{inst} \tag{0.5}$$

where ΔP_{fil} is the pressure drop across the filter and m is the measured slope. The pressure drop across the capillary is related to the flow rate by

$$\Delta p_{cap} = \frac{128 Q_{cap} m L}{\pi d^4}. \tag{0.6}$$

where

Δp_{fil} = pressure drop

m = gas viscosity = 1.83×10^{-4} g/cm-s

L = capillary length [cm] and

d = capillary diameter [cm].

Equation (0.6) is the Hagen-Poiselle equation of laminar flow through a pipe (Schlichting, 1979). The pressure drop across the capillary and the filter are nearly equal; thus setting equations (0.5) and (0.6) equal and substituting equation (0.4) gives

$$\begin{aligned} d &= \left(\frac{128 Q_{cap} m L}{\pi m Q_{inst}} \right)^{1/4} \\ &= \left(\frac{128 m L}{\pi m D_r} \right)^{1/4} \end{aligned} \tag{0.7}$$

The capillaries were made at the UMN glass blowing shop. The most suitable diameter available was 0.2 cm to attain a dilution ratio, D_r, between 14 and 16:1.

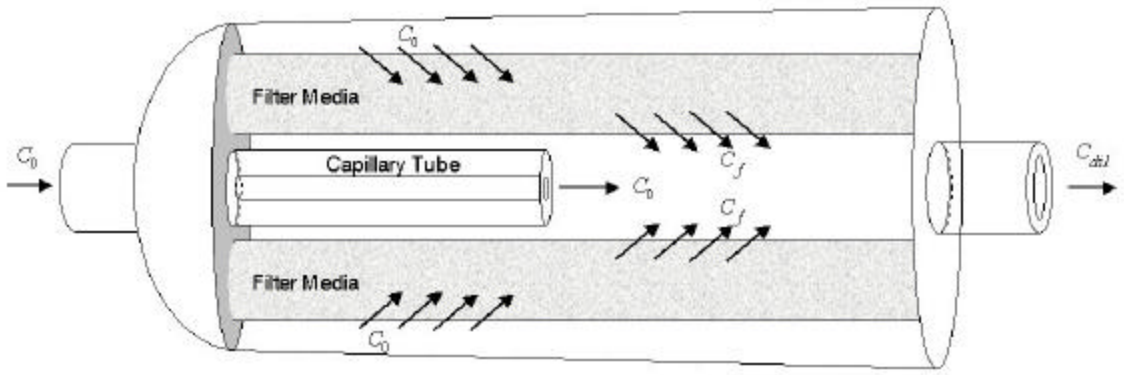

Figure A-1. Schematic diagram of the leaky filter

The dilutor was used to dilute aerosol for the PAS, DC, and CPC simultaneously. Figure A-2 is a schematic diagram of the dilutor and instrument set-up. A pressure gauge monitored the pressure drop across the filter. Filter loading will increase the pressure drop across the filter, which will increase the dilution ratio. In addition, a dilutor bypass was used to make quick changes from diluted to undiluted aerosol.

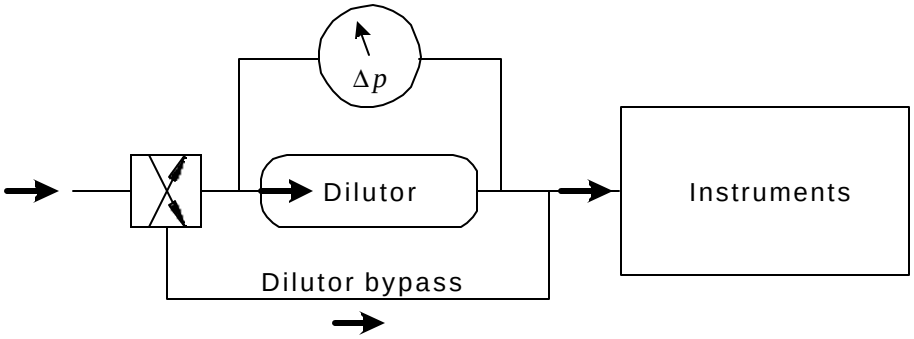

Figure A-2. Schematic diagram of dilutor and instrument application.

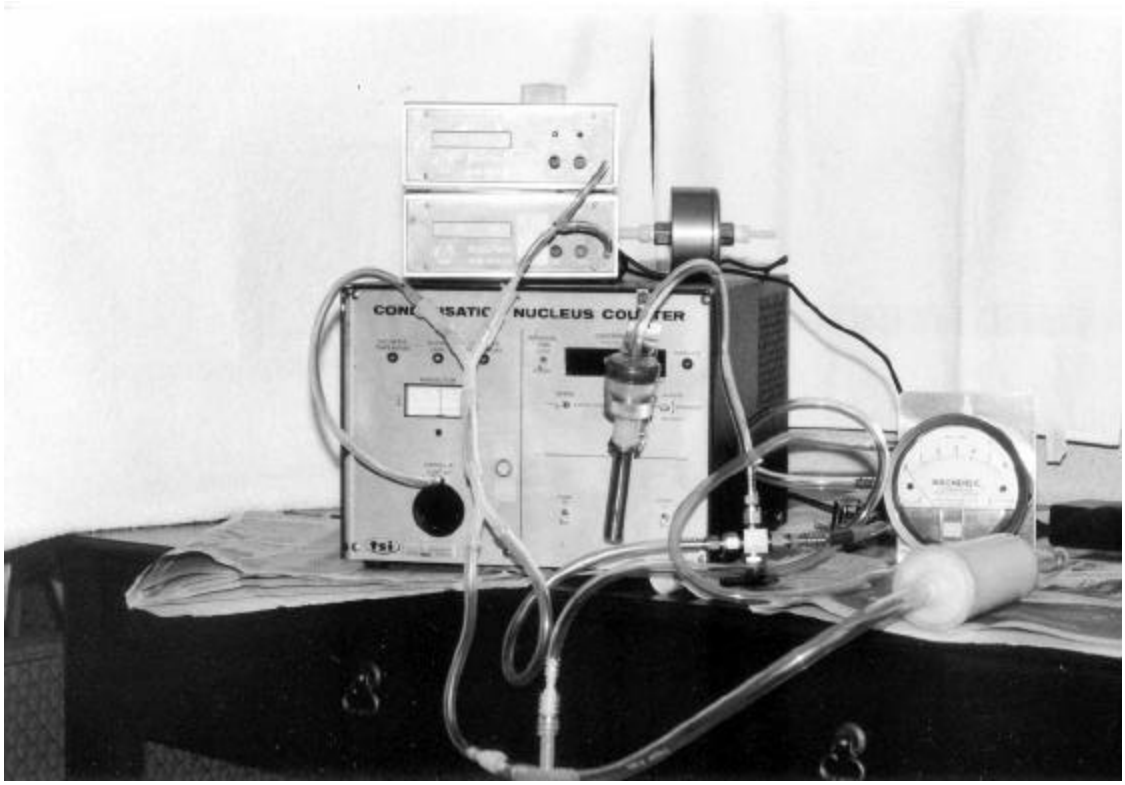

Figure A-3. Dilutor with the condensation nucleus counter instrument.

APPENDIX B. SAMPLES COLLECTED ON DRIVERS OR IN CABS

Table B-1. Size selective and elemental carbon samples collected on drivers or in cabs.

Date	Size selective sampler, mg/m^3		EC sampler, mg/m^3		
	< 0.8 μm	RD	OC	EC	TC
02/23/00	1.59	2.23	0.21	0.26	0.48
02/24/00	1.67	2.50	0.48	0.73	1.20
Mean	1.63	2.37	0.35	0.49	0.84
SD	0.06	0.19	0.19	0.33	0.51
02/28/00	0.45	0.90	0.27	0.09	0.36
02/28/00	0.42	0.82	0.26	0.09	0.35
02/29/00	0.59	1.20	ND	ND	ND
02/29/00	0.37	0.64	ND	ND	ND
03/01/00	0.27	0.53	0.22	0.03	0.25
03/01/00	0.23	0.60	0.28	0.06	0.34
03/02/00	0.46	1.31	0.27	0.05	0.31
03/02/00	0.85	1.55	0.39	0.12	0.51
03/02/00	ND	ND	0.28	0.07	0.35
03/02/00	ND	ND	0.24	0.12	0.36
03/03/00	0.26	1.11	0.17	0.03	0.19
03/03/00	0.30	0.69	0.34	0.04	0.38
Mean	0.42	0.93	0.27	0.07	0.34
SD	0.19	0.34	0.06	0.04	0.08

APPENDIX C. STATISTICAL TABLES

Table C-1. T-test results for the EC, OC and TC weighted week 1 and week 2 means.

Location	Parameter	t-test statistics						
		sp^2	sp	t	df	t_c	"P"	Reject Ho?
Upwind	EC (µg/m^3)	2994	54.7	23.6	8	2.31	1.089E-08	Yes
	OC (µg/m^3)	1079	32.9	6.2	8	2.31	2.546E-04	Yes
	TC (µg/m^3)	6898	83.1	18.6	8	2.31	7.106E-08	Yes
Vehicle	EC (µg/m^3)	2282	47.8	48.8	6	2.45	4.981E-09	Yes
	OC (µg/m^3)	1374	37.1	-2.9	6	2.45	2.911E-02	Yes
	TC (µg/m^3)	7531	86.8	23.2	6	2.45	4.223E-07	Yes
Downwind	EC (µg/m^3)	104	10.2	92.4	8	2.31	2.106E-13	Yes
	OC (µg/m^3)	173	13.2	13.0	8	2.31	1.187E-06	Yes
	TC (µg/m^3)	675	26.0	51.5	8	2.31	2.225E-11	Yes

Table C-2. T-test results for the SS < 0.8 µm and RD weighted week 1 and week 2 means.

Location	Parameter	t-test statistics						
		sp^2	sp	t	df	t_c	"P"	Reject Ho?
Upwind	< 0.8 µm (mg/m^3)	< 0.001	0.006	152.6	8	2.31	3.80E-15	Yes
	RD (mg/m^3)	0.002	0.042	36.4	8	2.31	3.57E-10	Yes
Vehicle	< 0.8 µm (mg/m^3)	0.001	0.026	149.5	8	2.31	4.49E-15	Yes
	RD (mg/m^3)	0.013	0.112	0.7	8	2.31	5.14E-01	No
Downwind	< 0.8 µm (mg/m^3)	0.001	0.027	29.4	8	2.31	1.94E-09	Yes
	RD (mg/m^3)	0.001	0.035	18.6	8	2.31	7.28E-08	Yes

Table C-3. T-test results for the DC, CPC and PAS weighted week 1 and week 2 means.

Location	Parameter	t-test						
		sp^2	sp	t	df	t_c	"P"	Reject Ho?
Downwind	DC (fA)	2.77E+02	1.66E+01	11.85	8	2.31	2.36E-06	Yes
	PAS (ng/m^3)	7.76E+02	2.79E+01	11.94	8	2.31	2.22E-06	Yes
	CPC (part/cm^3)	5.14E+08	2.27E+04	9.78	7	2.36	2.48E-05	Yes

Table C-4. T-test results for the Hi-volume sampler derived DPM, SOF, sulfate, and SOL week 1 and week 2 weighted mean values.

		t-test statistics						
Location	Parameter	sp^2	sp	t	df	"P"	t_c	Reject Ho?
Upwind	DPM (mg/m^3)	0.002	0.045	45.85	7	6.13E-10	2.365	Yes
	SOF (mg/m^3)	<0.001	0.011	5.390	7	0.001	2.365	Yes
	SO4(mg/m^3)	<0.001	<0.001	13.42	7	3.00E-06	2.365	Yes
	SOL (mg/m^3)	<0.001	0.0267	71.90	7	2.65E-11	2.365	Yes
Downwind	DPM (mg/m^3)	0.032	0.178	15.39	8	3.16E-07	2.306	Yes
	SOF (mg/m^3)	<0.001	0.007	3.471	8	0.008	2.306	Yes
	SO4 (mg/m^3)	<0.001	0.001	10.30	8	6.82E-06	2.306	Yes
	SOL (mg/m^3)	0.030	0.173	15.81	8	2.56E-07	2.306	Yes

Table C-5. T-test results for the Hi-volume sampler derived PAH and hopane downwind week 1 and week 2 weighted mean values.

	t-test statistics							
Compound (ng/m3)	sp2	sp	t	df	alpha	t_c	"P"	Reject Ho?
Phenanthrene	1025.3	32.02	4.127	8	0.05	2.306	0.003	Yes
Anthracene	2.434	1.560	3.769	8	0.05	2.306	0.005	Yes
Methyl-178PAH	4092	63.97	4.129	8	0.05	2.306	0.003	Yes
Dimethyl-178PAH	4327	65.78	3.974	8	0.05	2.306	0.004	Yes
Trimethyl-178PAH	0.237	0.487	3.832	8	0.05	2.306	0.005	Yes
Fluoranthene	622.8	24.96	3.551	8	0.05	2.306	0.008	Yes
Acephenanthrylene	14.97	3.869	3.216	8	0.05	2.306	0.012	Yes
Pyrene	1810	42.55	3.560	8	0.05	2.306	0.007	Yes
Methyl-202PAH	734.1	27.09	3.329	8	0.05	2.306	0.010	Yes
Dimethyl-202PAH	368.5	19.20	3.212	8	0.05	2.306	0.012	Yes
Benzo[ghi]fluoranthene	46.18	6.796	2.731	8	0.05	2.306	0.026	Yes
Benzo[a]anthracene	3.997	1.999	2.222	8	0.05	2.306	0.057	No
Cyclopenta[cd]pyrene	18.72	4.327	2.226	8	0.05	2.306	0.057	No
Chrysene+Triphenylene	13.95	3.734	2.630	8	0.05	2.306	0.030	Yes
Benzo[k]fluoranthene	2.024	1.423	1.938	8	0.05	2.306	0.089	No
Benzo[b]fluoranthene	1.188	1.090	1.767	8	0.05	2.306	0.115	No
Benzo[j]fluoranthene	0.205	0.452	1.953	8	0.05	2.306	0.087	No
Benzo[e]pyrene	2.776	1.666	2.180	8	0.05	2.306	0.061	No
Benzo[a]pyrene	1.298	1.139	2.074	8	0.05	2.306	0.072	No
Indeno[cd]pyrene	0.253	0.503	1.663	8	0.05	2.306	0.135	No
Benzo[ghi]perylene	0.001	0.035	1.787	8	0.05	2.306	0.112	No
Dibenzo[ah]anthracene	1.744	1.321	1.777	8	0.05	2.306	0.113	No
22,29,30-Trisnorhopane	29.03	5.388	3.342	8	0.05	2.306	0.010	No
17a(H),21b(H)-29-Norhopane	2.961	1.721	2.204	8	0.05	2.306	0.059	No
17a(H),21b(H)-Hopane	482.3	21.96	2.518	8	0.05	2.306	0.036	Yes
22S-17a(H),21b(H)-30-Homohopane	64.93	8.058	2.515	8	0.05	2.306	0.036	Yes
22R-17a(H),21b(H)-30-Homohopane	63.84	7.990	2.501	8	0.05	2.306	0.037	Yes
22S-17a(H),21b(H)-30-Bishomohopane	38.73	6.223	2.227	8	0.05	2.306	0.057	No
22R-17a(H),21b(H)-30-Bishomohopane	18.08	4.253	2.295	8	0.05	2.306	0.051	No

Table C-6. T-test results for the Hi-volume sampler-derived PAH and hopane upwind week 1 and week 2 weighted mean values.

	t-test statistics							
Compound (ng/m3)	sp2	sp	t	df	alpha	t_c	"P"	Reject Ho?
Phenanthrene	2910	53.94	2.636	7	0.05	2.365	0.034	Yes
Anthracene	6.549	2.559	2.668	7	0.05	2.365	0.032	Yes
Methyl-178PAH	9307	96.47	2.924	7	0.05	2.365	0.022	Yes
Dimethyl-178PAH	7755	88.06	3.245	7	0.05	2.365	0.014	Yes
Trimethyl-178PAH	0.480	0.693	4.232	7	0.05	2.365	0.004	Yes
Fluoranthene	429.2	20.72	3.679	7	0.05	2.365	0.008	Yes
Acephenanthrylene	14.88	3.858	3.292	7	0.05	2.365	0.013	Yes
Pyrene	1103	33.22	3.788	7	0.05	2.365	0.007	Yes
Methyl-202PAH	506.4	22.50	3.536	7	0.05	2.365	0.010	Yes
Dimethyl-202PAH	136.8	11.70	3.570	7	0.05	2.365	0.009	Yes
Benzo[ghi]fluoranthene	5.030	2.243	6.972	7	0.05	2.365	0.000	Yes
Benzo[a]anthracene	0.637	0.798	6.086	7	0.05	2.365	0.000	Yes
Cyclopenta[cd]pyrene	1.259	1.122	7.959	7	0.05	2.365	0.000	Yes
Chrysene+Triphenylene	2.766	1.663	5.686	7	0.05	2.365	0.001	Yes
Benzo[k]fluoranthene	0.215	0.464	4.864	7	0.05	2.365	0.002	Yes
Benzo[b]fluoranthene	0.149	0.387	4.666	7	0.05	2.365	0.002	Yes
Benzo[j]fluoranthene	0.044	0.209	2.873	7	0.05	2.365	0.024	Yes
Benzo[e]pyrene	0.150	0.387	8.011	7	0.05	2.365	0.000	Yes
Benzo[a]pyrene	0.123	0.350	6.144	7	0.05	2.365	0.000	Yes
Indeno[cd]pyrene	0.037	0.191	4.054	7	0.05	2.365	0.005	Yes
Benzo[ghi]perylene	0.000	0.008	0.653	7	0.05	2.365	0.534	No
Dibenzo[ah]anthracene	0.106	0.326	5.640	7	0.05	2.365	0.001	Yes
22,29,30-Trisnorhopane	31.25	5.590	3.348	7	0.05	2.365	0.012	Yes
17a(H),21b(H)-29-Norhopane	1.292	1.137	2.972	7	0.05	2.365	0.021	Yes
17a(H),21b(H)-Hopane	243.1	15.59	3.800	7	0.05	2.365	0.007	Yes
22S-17a(H),21b(H)-30-Homohopane	25.38	5.038	3.550	7	0.05	2.365	0.009	Yes
22R-17a(H),21b(H)-30-Homohopane	27.64	5.257	3.747	7	0.05	2.365	0.007	Yes
22S-17a(H),21b(H)-30-Bishomohopane	17.61	4.196	3.494	7	0.05	2.365	0.010	Yes
22R-17a(H),21b(H)-30-Bishomohopane	4.279	2.069	4.571	7	0.05	2.365	0.003	Yes

Table C-7. T-test results for the Hi-volume sampler derived biological (mutagenic) activity week 1 and week 2 weighted mean values.

		t-test statistics						
Location	Parameter	sp2	sp	t	df	"P"	t_c	Reject Ho?
Upwind	98-S9 (rev/m^3)	1.034	1.017	1.129	7	0.296	2.365	No
	98+S9 (rev/m^3)	0.031	0.178	1.857	7	0.107	2.365	No
	100-S9 (rev/m^3)	3.12	1.767	1.991	7	0.087	2.365	No
Downwind	98-S9 (rev/m^3)	0.231	0.48	1.738	8	0.12	2.306	No
	98+S9 (rev/m^3)	0.017	0.13	1.63	8	0.141	2.306	No
	100-S9 (rev/m^3)	0.296	0.544	2.392	8	0.044	2.306	Yes

APPENDIX D. CPC, DC, AND PAS DATA

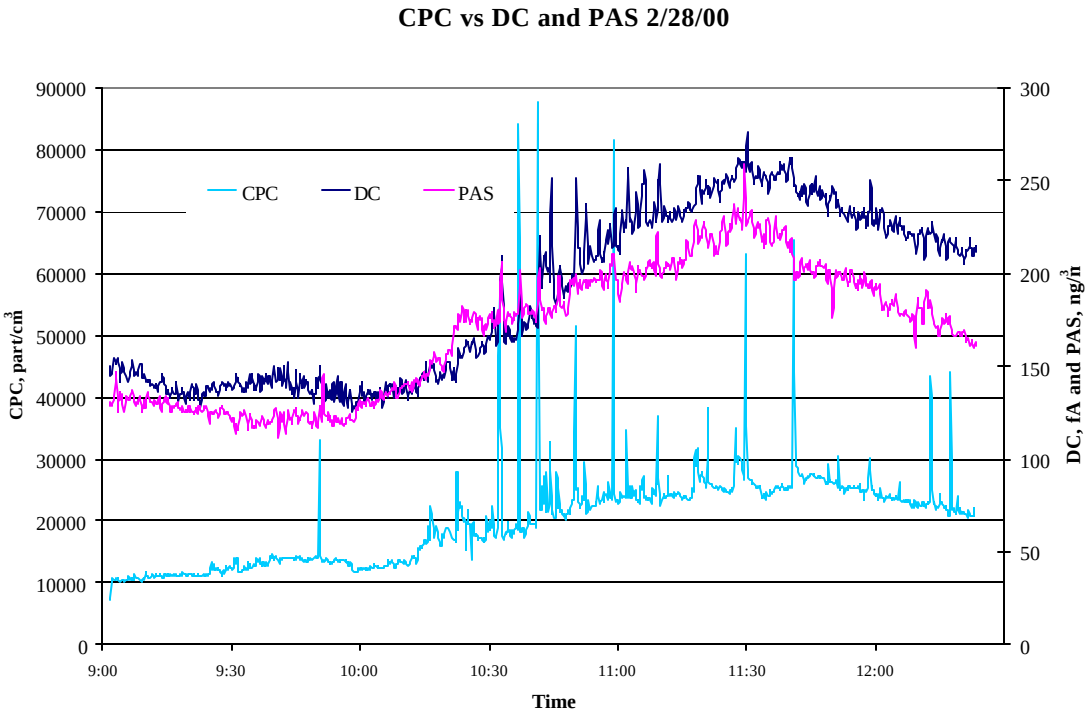

Figure D-1. DC, PAS, and CPC strip chart for 2/28/00

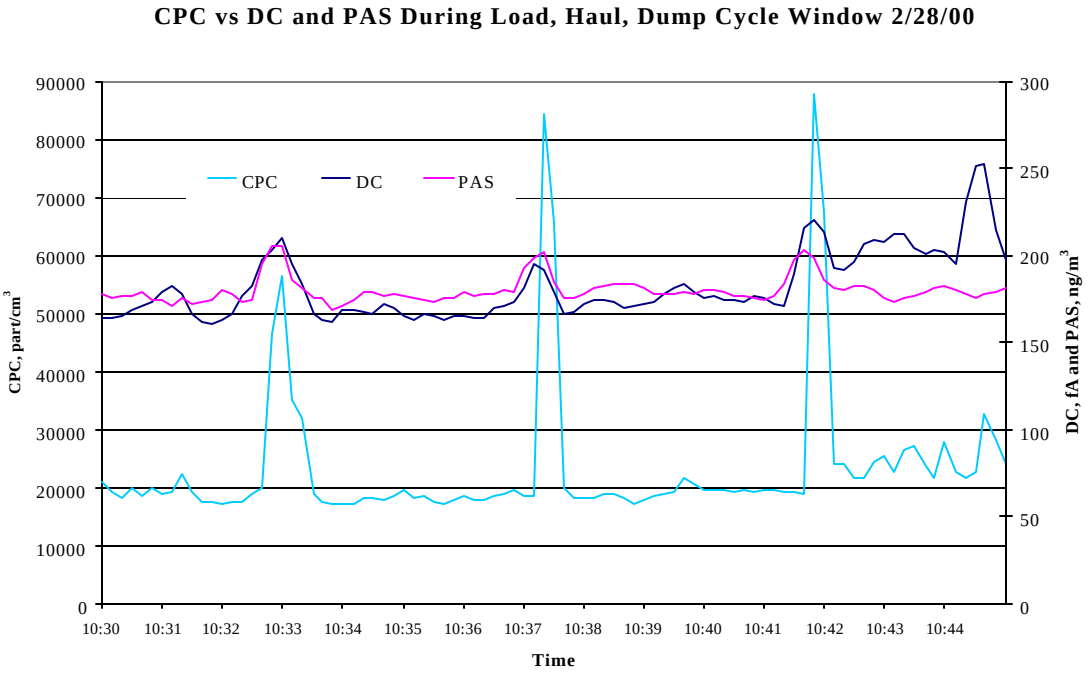

Figure D-2. DC, PAS, and CPC strip chart during a load, haul dump cycle, 2/28/00

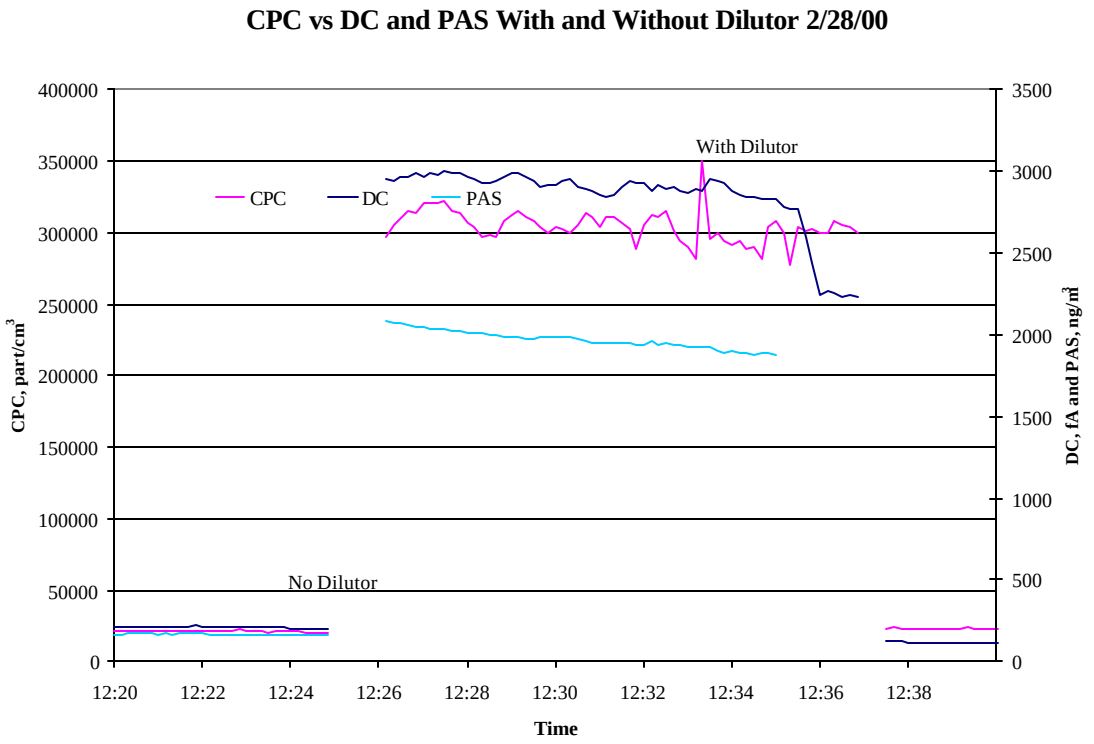

Figure D-3. DC, PAS, and CPC with and without leaky filter dilutor, 2/28/00

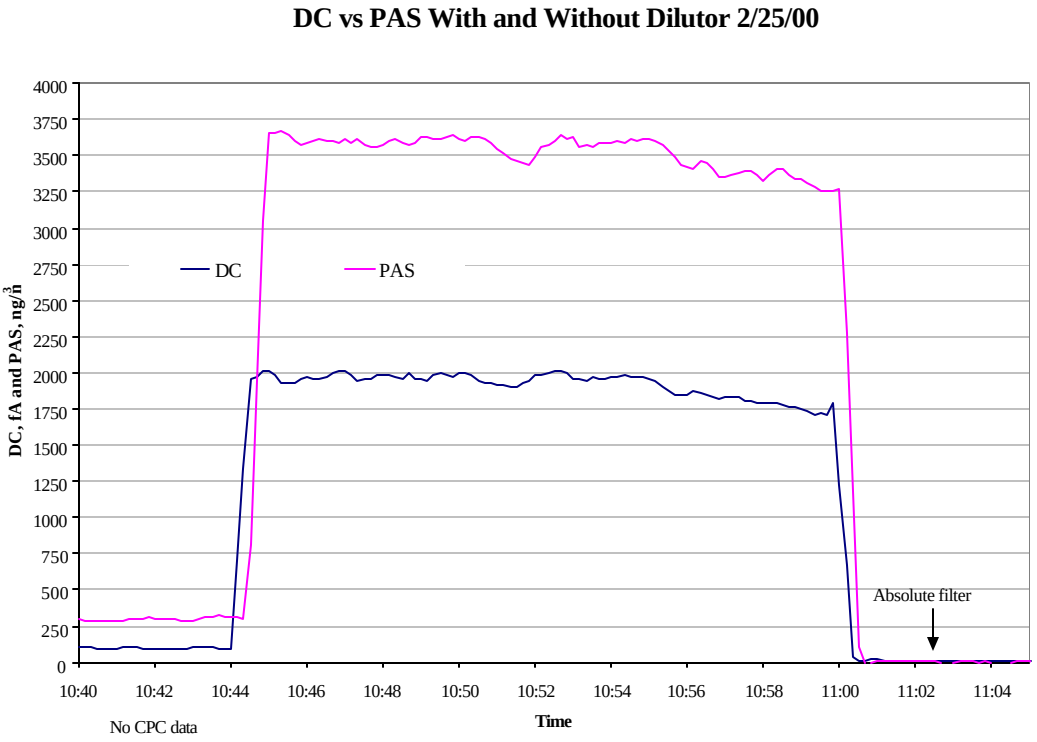

Figure D-4. DC and PAS with and without leaky filter dilutor or absolute filter, 2/25/00

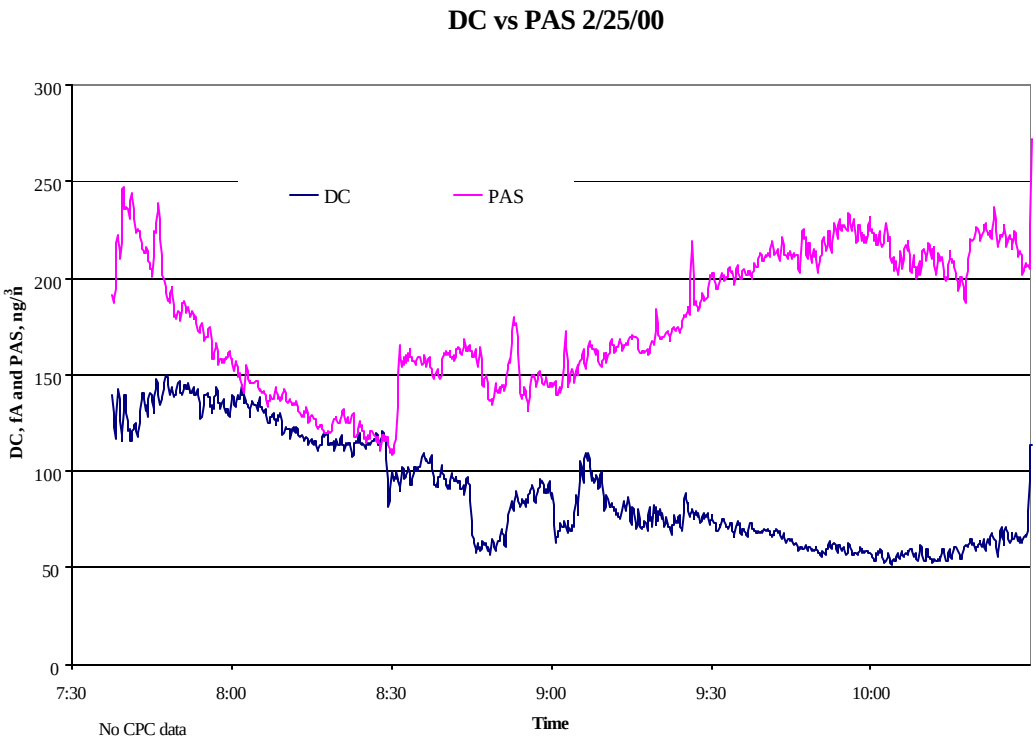

Figure D-5. DC and PAS strip chart for 2/25/00

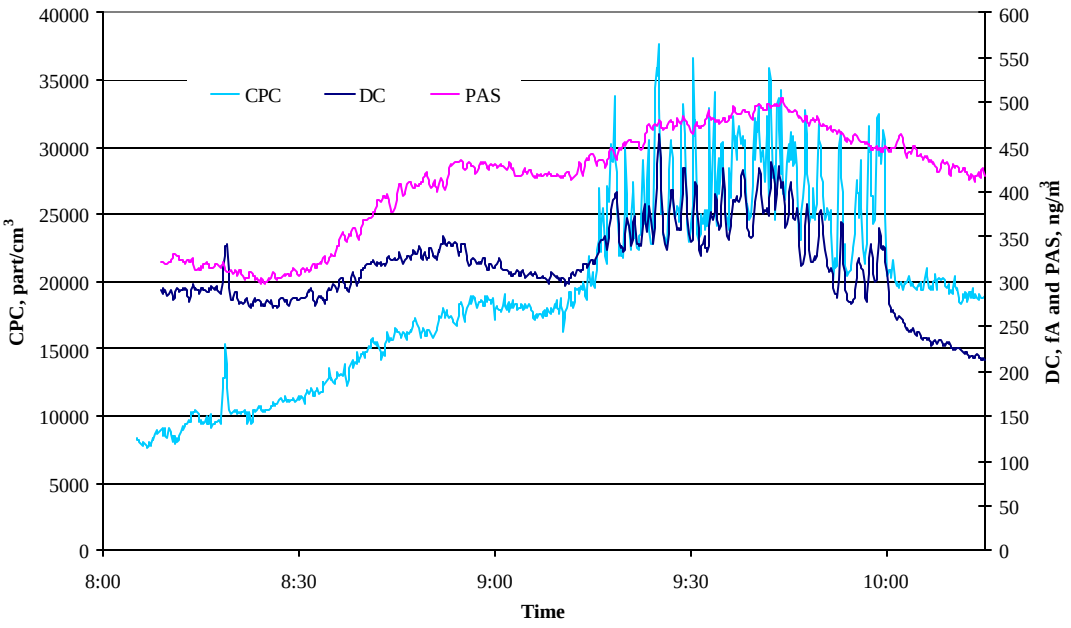

Figure D-6. DC, PAS and CPC strip chart for 2/24/00

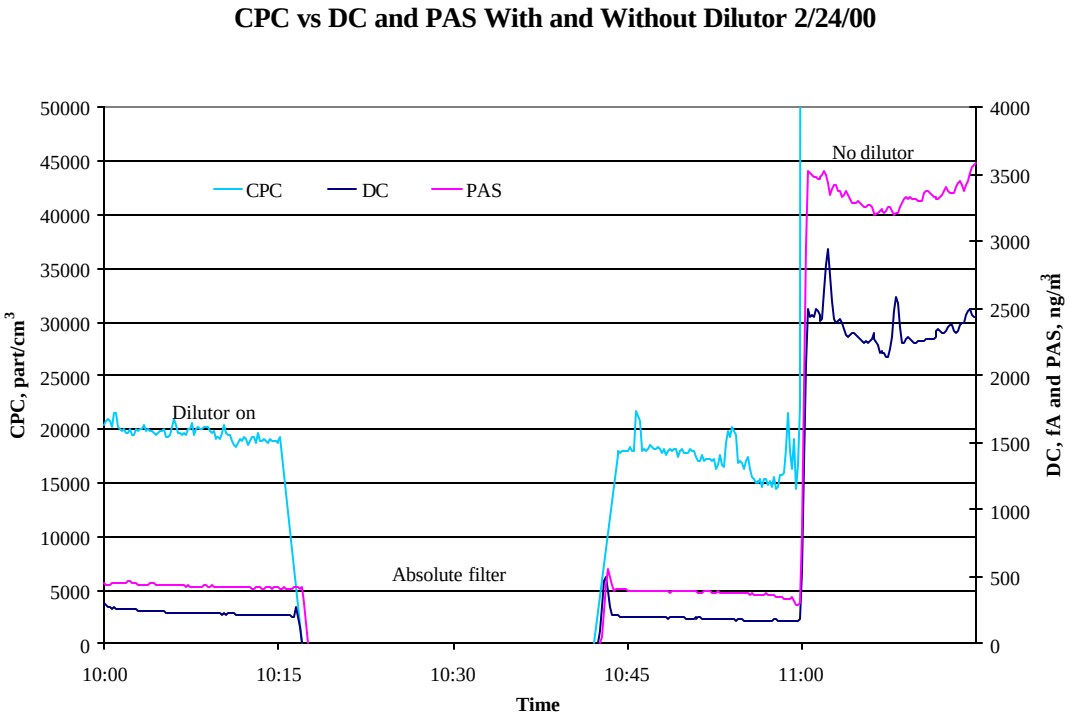

Figure D-7. DC, PAS and CPC with and without leaky filter dilutor or absolute filter, 2/24/00

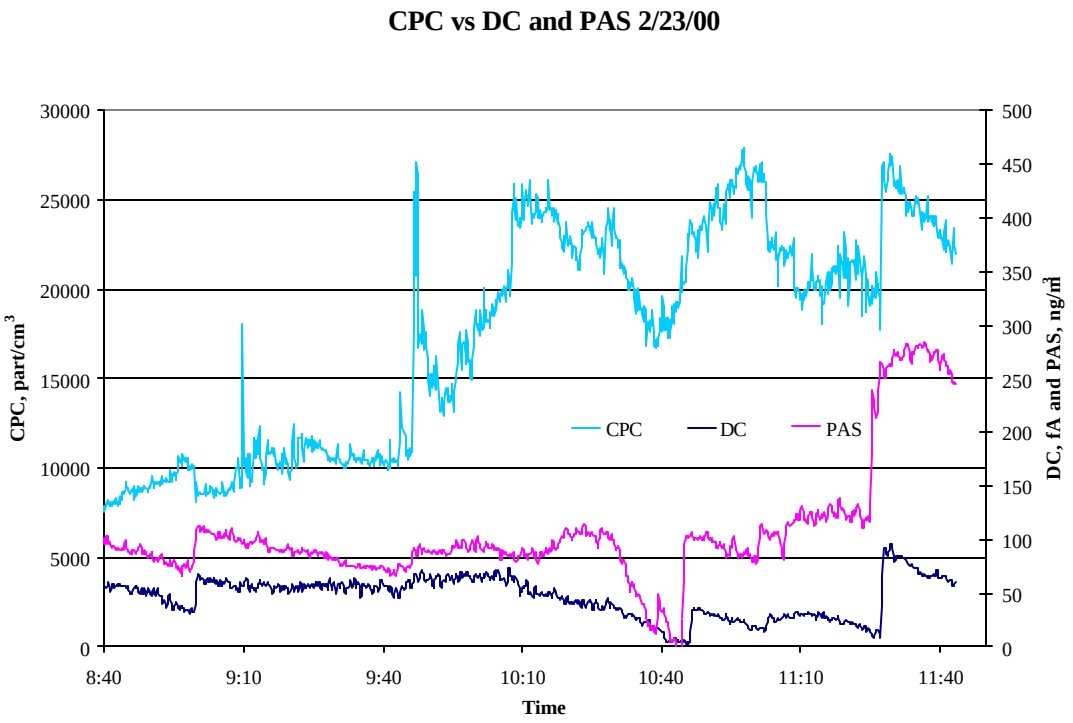

Figure D-8. DC, PAS, and CPC strip chart, 2/23/00

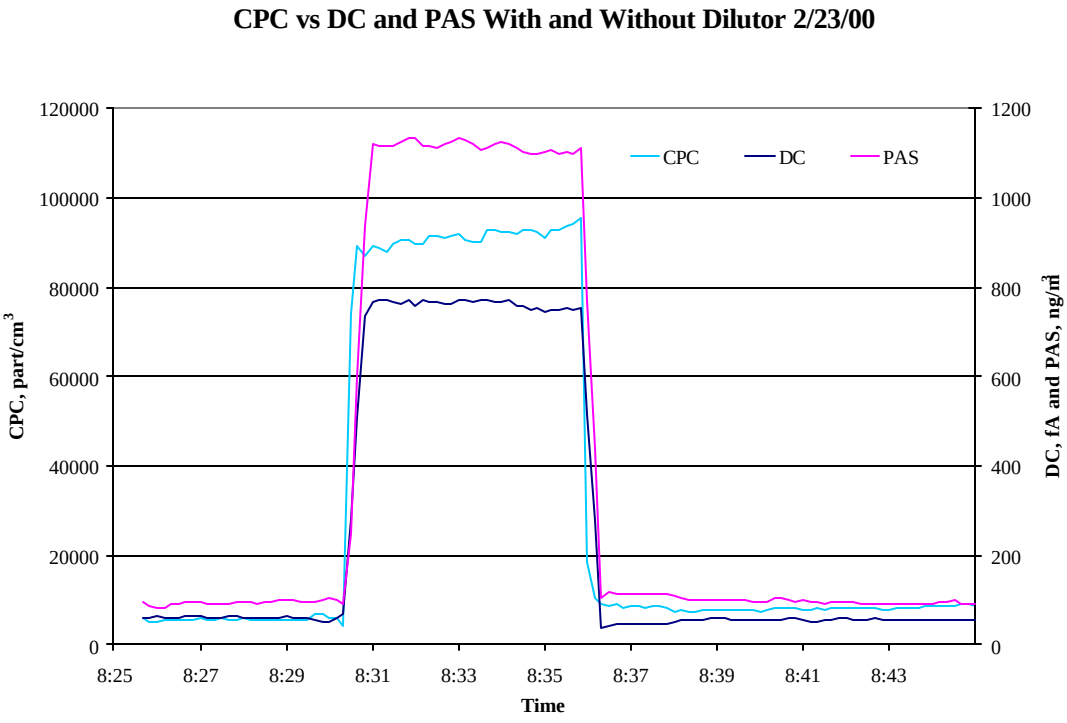

Figure D-9. DC, PAS and CPC with and without leaky filter dilutor, 2/23/00

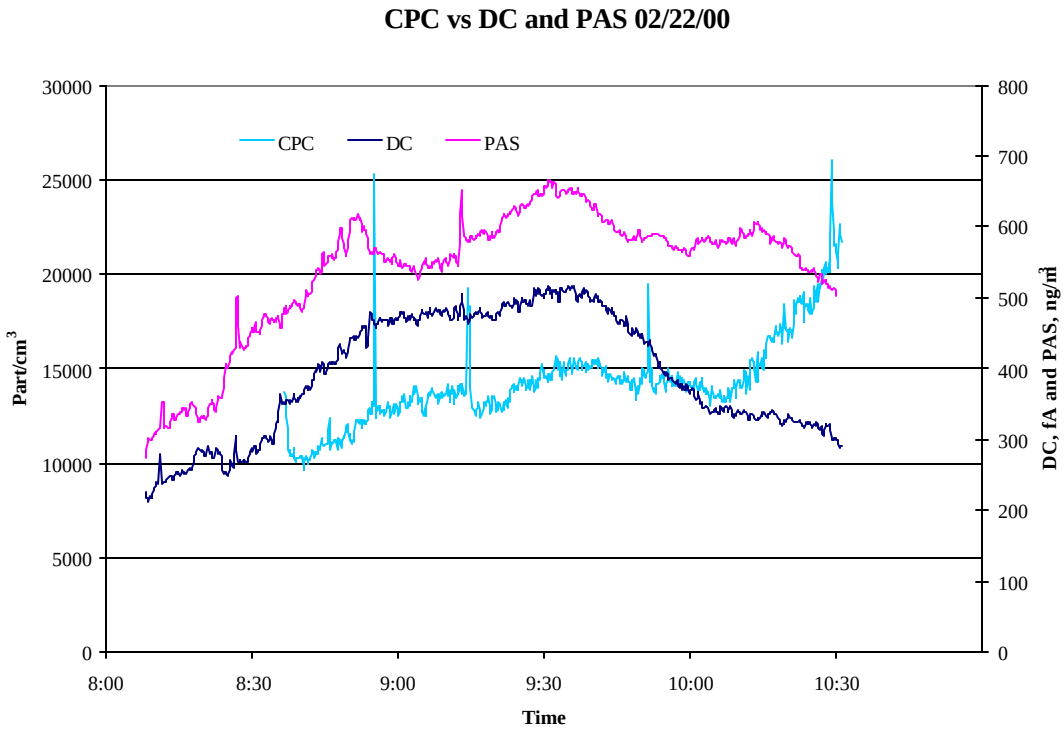

Figure D-10. DC, PAS and CPC strip chart, 2/22/00

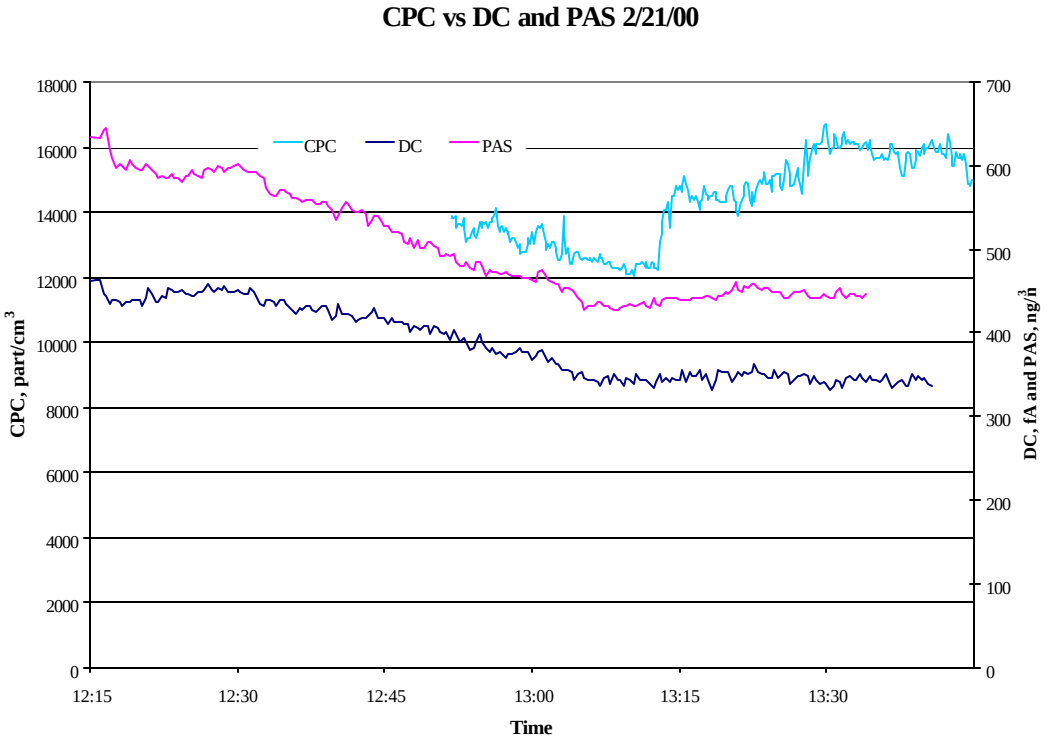

Figure D-11. DC, PAS and CPC strip chart, 2/21/00

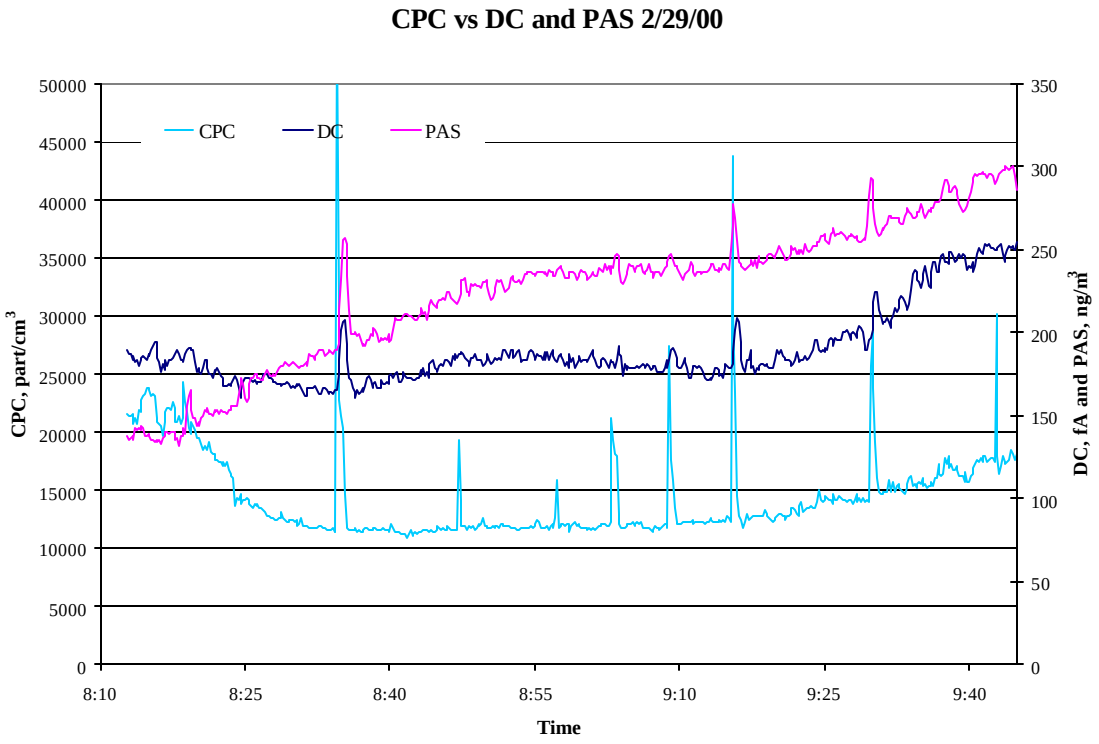

Figure D-12. DC, PAS and CPC strip chart, 2/29/00

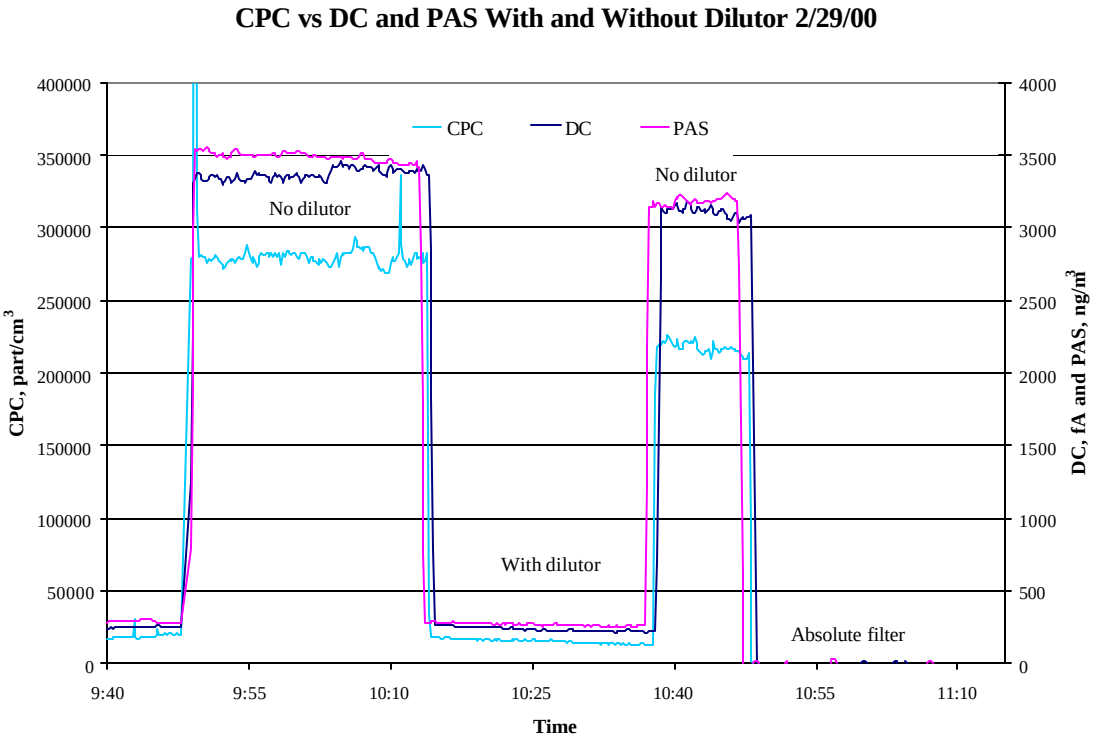

Figure D-13. DC, PAS and CPC with and without leaky filter dilutor or absolute filter, 2/29/00

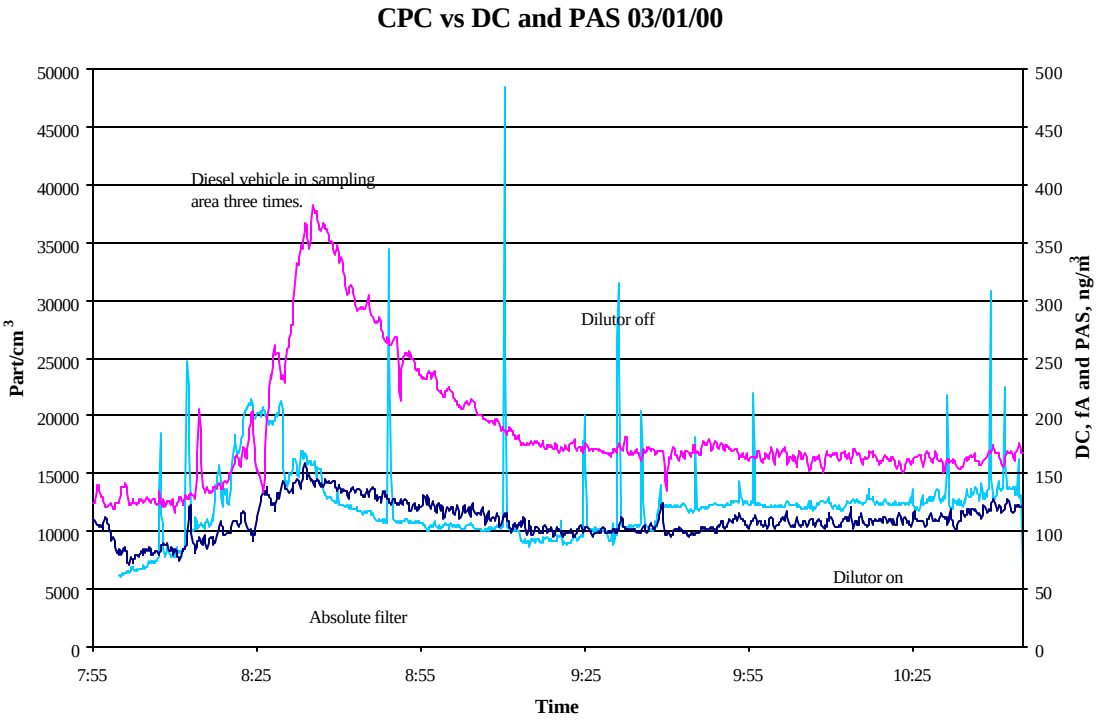

Figure D-14. DC, PAS, and CPC strip chart 3/1/00

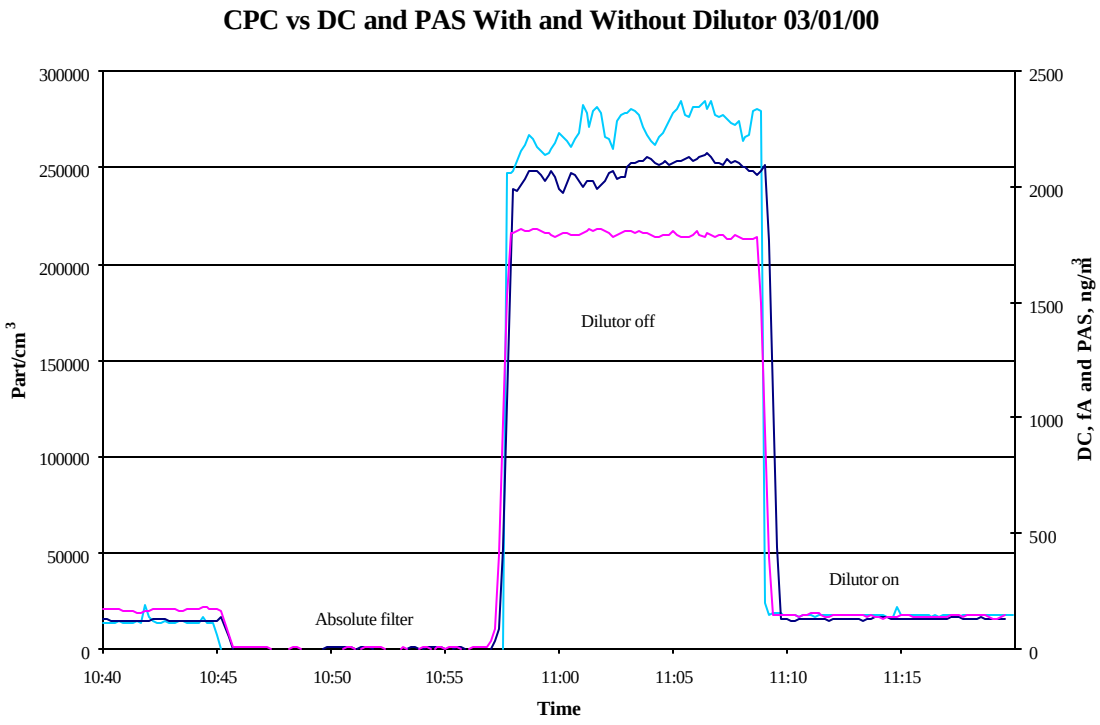

Figure D-15. DC, PAS and CPC with and without leaky filter dilutor or absolute filter, 3/1/00

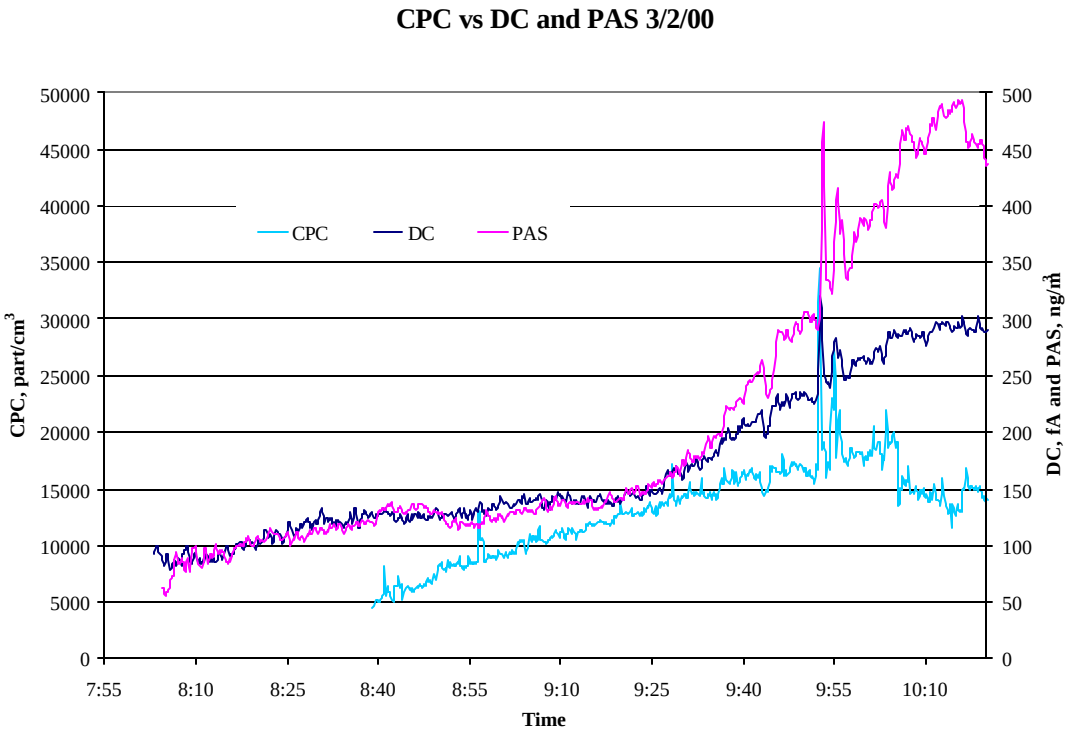

Figure D-16. DC, PAS, and CPC strip chart, 3/2/00

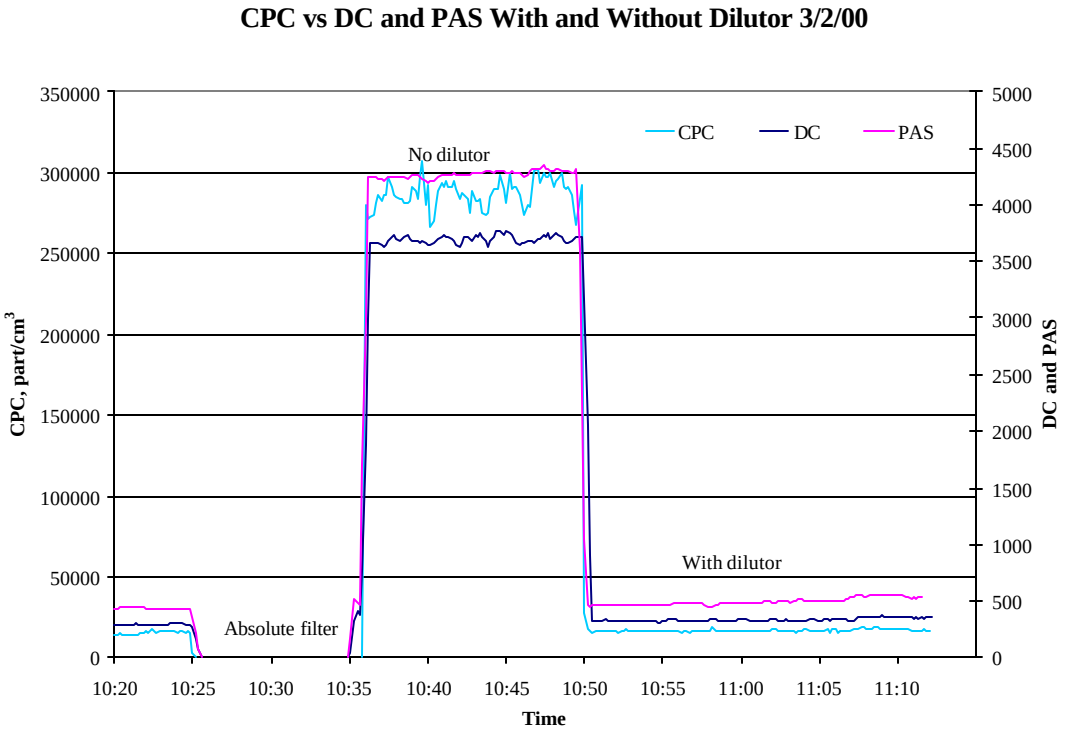

Figure D-17. DC, PAS and CPC with and without leaky filter dilutor or absolute filter, 3/2/00

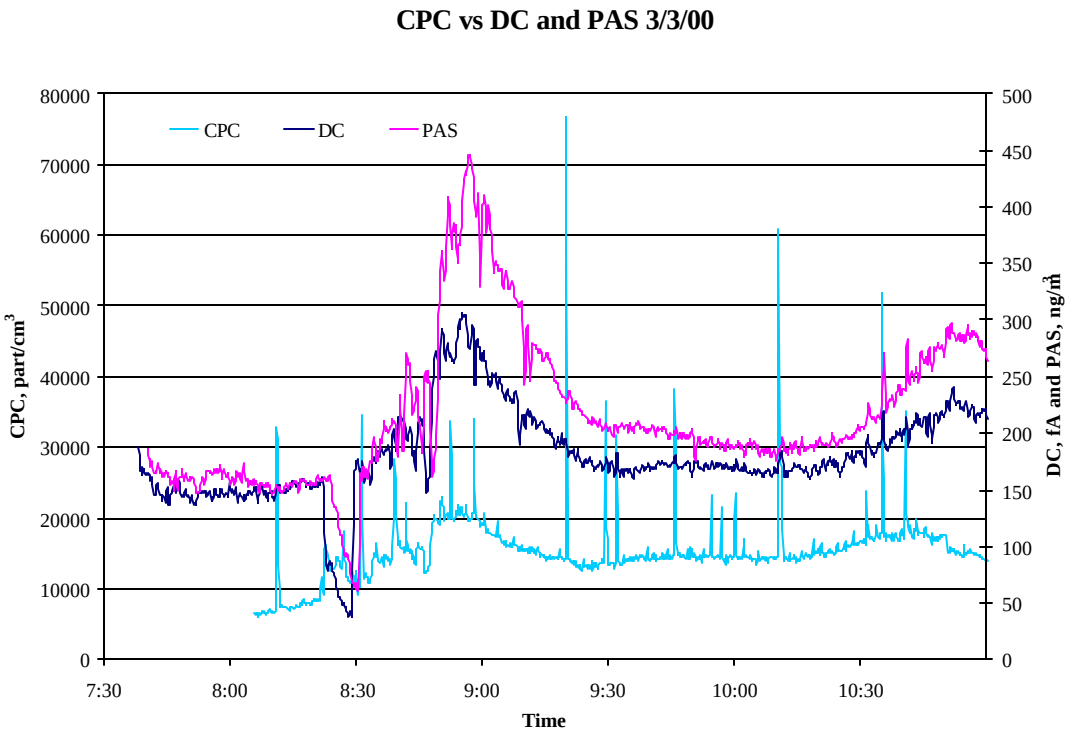

Figure D-18. DC, PAS and CPC strip chart, 3/3/00

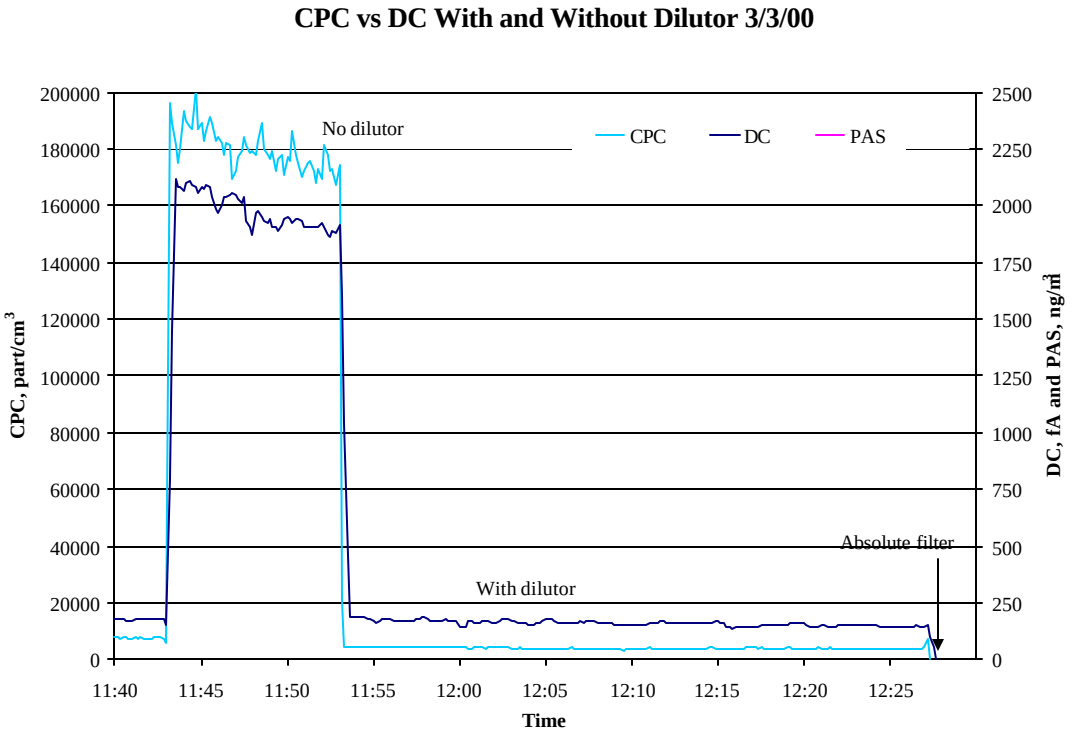

Figure D-19. DC, PAS and CPC with and without leaky filter dilutor or absolute filter, 3/3/00

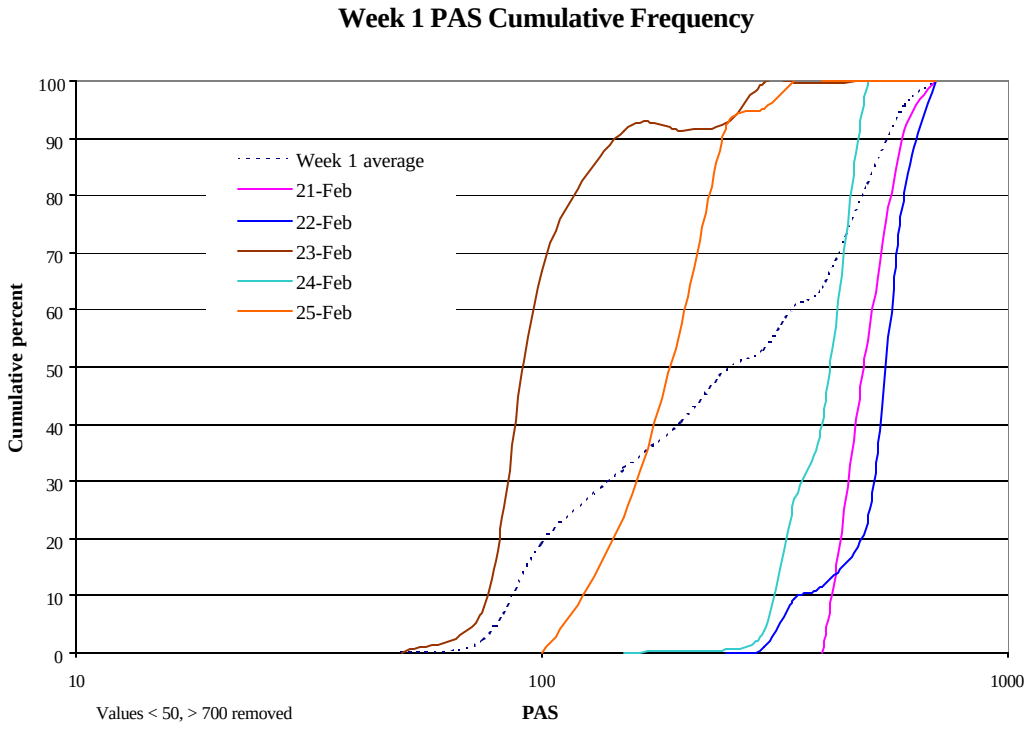

Figure D-20. Week 1 PAS cumulative frequency plot

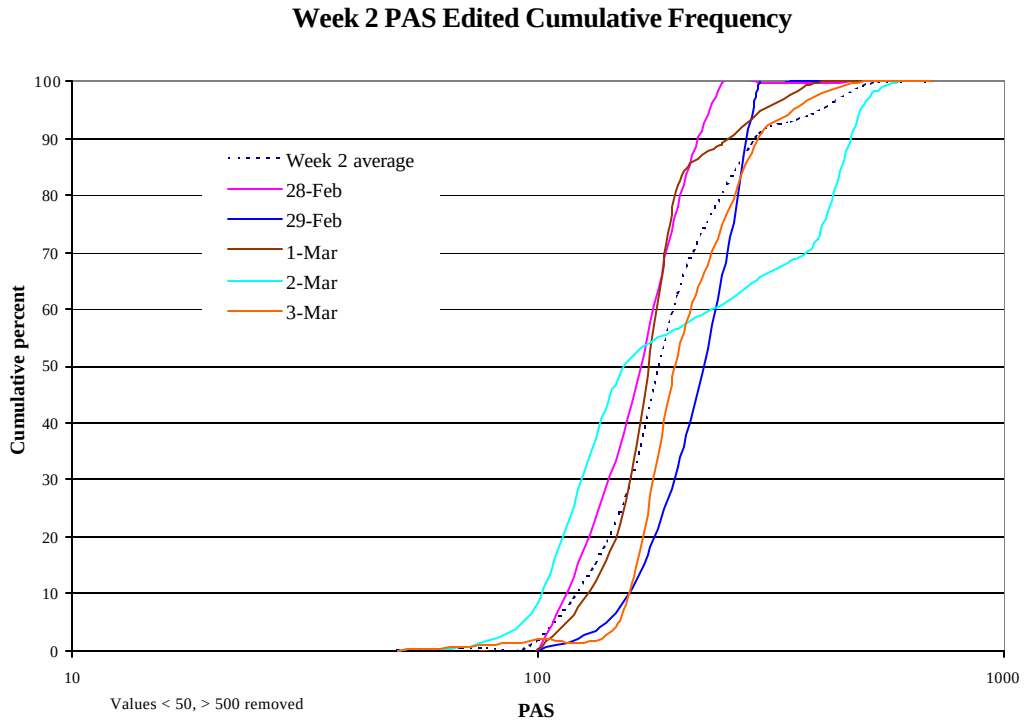

Figure D-21. Week 2 PAS cumulative frequency plot

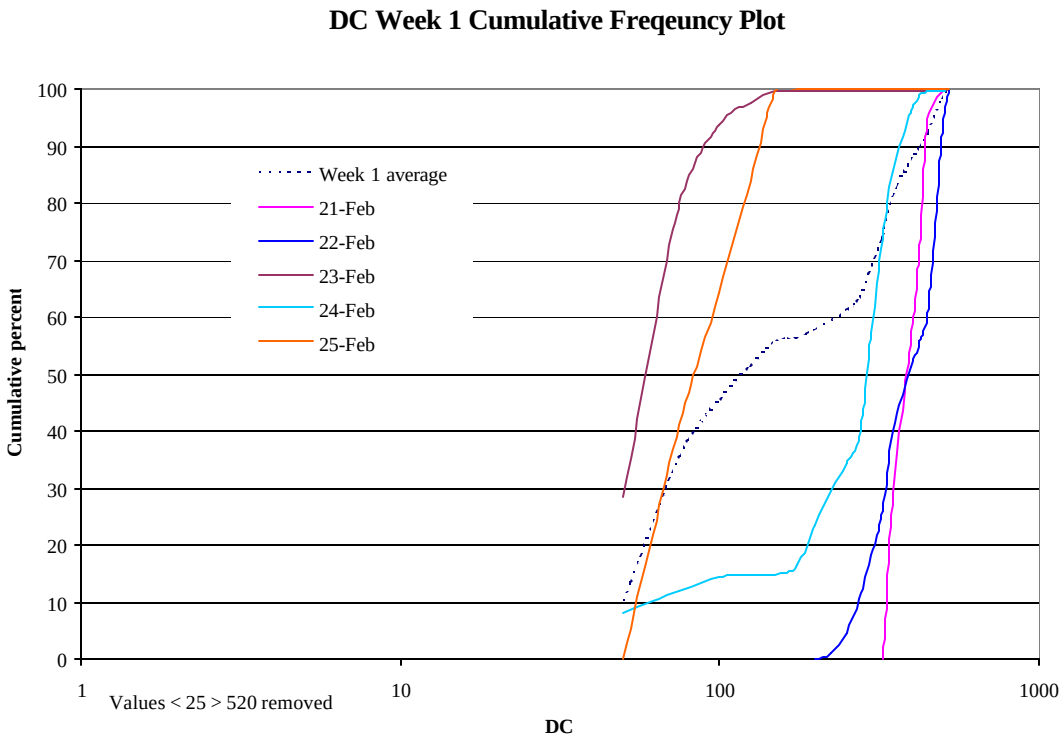

Figure D-22. Week 1 DC cumulative frequency plot

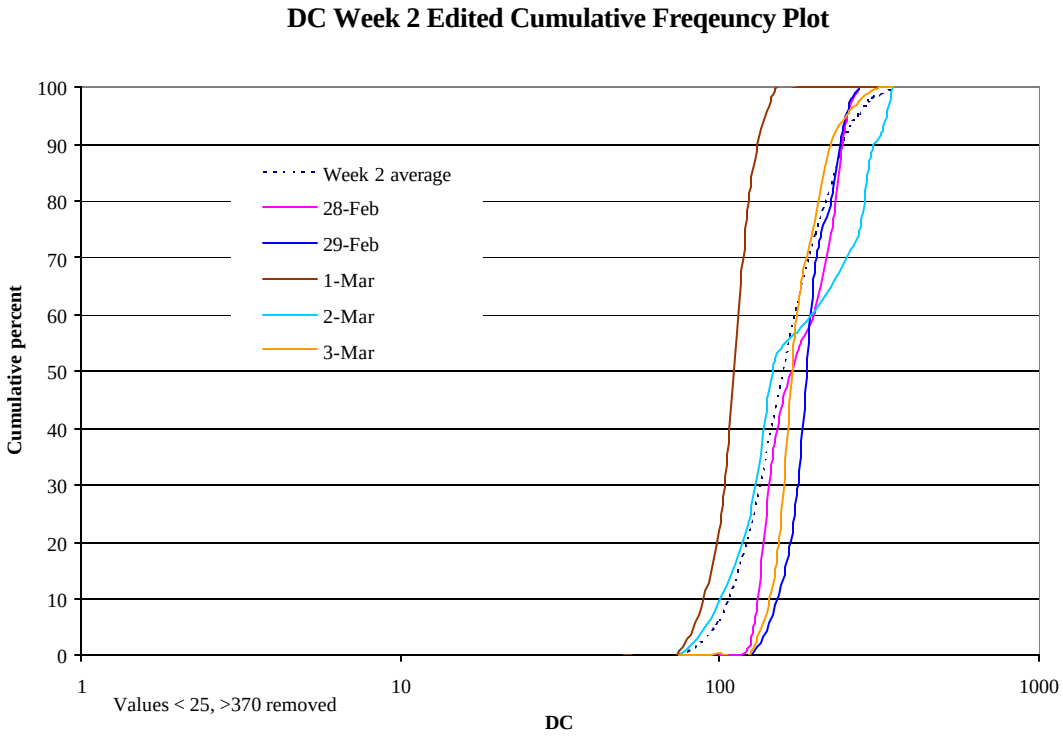

Figure D-23. Week 2 DC cumulative frequency plot

APPENDIX E. PAH AND HOPANE DAILY VALUES

Table E-1. Daily PAH and hopane concentrations (ng/m^3) detected at the downwind sampling site.

Compound	Week 1 Sampling Date					Mean	SD	Week 2 Sampling Date					Mean	SD
	02/21/01	02/22/00	02/23/00	02/24/00	02/25/00			02/28/00	02/29/00	03/01/00	03/02/00	03/03/00		
Phenanthrene	1.28E+02	1.57E+02	4.48E+01	1.09E+02	6.95E+01	1.02E+02	4.50E+01	1.05E+01	1.35E+01	9.70E+00	2.19E+01	9.50E+00	1.30E+01	5.20E+00
Anthracene	6.22E+00	7.14E+00	2.04E+00	4.73E+00	2.71E+00	4.57E+00	2.19E+00	5.28E-01	5.49E-01	5.27E-01	1.05E+00	4.64E-01	6.23E-01	2.39E-01
Methyl-178PAH	2.71E+02	2.88E+02	8.21E+01	2.41E+02	1.37E+02	2.04E+02	8.98E+01	2.26E+01	2.62E+01	1.85E+01	4.59E+01	1.92E+01	2.65E+01	1.13E+01
Dimethyl-178PAH	2.72E+02	2.63E+02	7.51E+01	2.71E+02	1.34E+02	2.03E+02	9.24E+01	2.46E+01	2.72E+01	1.91E+01	4.65E+01	2.08E+01	2.76E+01	1.10E+01
Trimethyl-178PAH	1.70E+00	1.56E+00	4.44E-01	2.33E+00	1.40E+00	1.49E+00	6.82E-01	2.12E-01	2.12E-01	1.77E-01	4.07E-01	1.63E-01	2.34E-01	9.90E-02
Fluoranthene	9.14E+01	8.75E+01	2.50E+01	1.02E+02	3.61E+01	6.84E+01	3.52E+01	8.49E+00	9.27E+00	7.38E+00	1.27E+01	7.01E+00	8.97E+00	2.26E+00
Acephenanthrylene	1.54E+01	1.19E+01	3.40E+00	1.21E+01	3.59E+00	9.28E+00	5.47E+00	1.06E+00	7.76E-01	8.17E-01	1.27E+00	7.60E-01	9.36E-01	2.22E-01
Pyrene	1.59E+02	1.49E+02	4.26E+01	1.73E+02	6.28E+01	1.17E+02	6.01E+01	1.40E+01	1.61E+01	1.35E+01	2.21E+01	1.31E+01	1.58E+01	3.75E+00
Methyl-202PAH	9.25E+01	8.86E+01	2.53E+01	1.15E+02	3.82E+01	7.18E+01	3.82E+01	1.03E+01	1.11E+01	8.80E+00	1.68E+01	9.66E+00	1.13E+01	3.17E+00
Dimethyl-202PAH	6.87E+01	6.56E+01	1.87E+01	7.09E+01	2.01E+01	4.88E+01	2.69E+01	5.88E+00	5.24E+00	5.52E+00	1.37E+01	6.77E+00	7.43E+00	3.57E+00
Benzo[ghi]fluoranthene	2.45E+01	1.35E+01	3.86E+00	2.31E+01	5.42E+00	1.41E+01	9.59E+00	1.77E+00	9.86E-01	1.58E+00	2.47E+00	1.30E+00	1.62E+00	5.60E-01
Benzo[a]anthracene	5.97E+00	3.02E+00	8.62E-01	6.90E+00	8.59E-01	3.52E+00	2.82E+00	6.46E-01	2.56E-01	5.10E-01	7.78E-01	5.25E-01	5.43E-01	1.93E-01
Cyclopenta[cd]pyrene	1.59E+01	5.20E+00	1.48E+00	1.05E+01	2.06E+00	7.03E+00	6.11E+00	6.39E-01	2.06E-01	7.17E-01	8.32E-01	4.47E-01	5.68E-01	2.46E-01
Chrysene+Triphenylene	1.17E+01	8.05E+00	2.30E+00	1.43E+01	3.01E+00	7.87E+00	5.26E+00	1.30E+00	7.43E-01	1.20E+00	1.96E+00	1.23E+00	1.29E+00	4.35E-01
Benzo[k]fluoranthene	3.75E+00	1.09E+00	3.11E-01	4.56E+00	3.01E-01	2.00E+00	2.01E+00	5.65E-02	7.67E-02	1.66E-01	2.04E-01	2.61E-01	1.53E-01	8.59E-02
Benzo[b]fluoranthene	2.86E+00	7.85E-01	2.24E-01	3.46E+00	2.70E-01	1.52E+00	1.53E+00	5.69E-01	2.76E-02	1.35E-01	2.02E-01	2.06E-01	2.28E-01	2.04E-01
Benzo[j]fluoranthene	6.61E-01	8.74E-01	2.49E-01	1.85E+00	4.10E-01	8.08E-01	6.28E-01	4.21E-01	1.87E-01	1.22E-01	2.22E-01	1.27E-01	2.16E-01	1.22E-01
Benzo[e]pyrene	4.79E+00	1.91E+00	5.45E-01	5.68E+00	8.00E-01	2.75E+00	2.35E+00	3.53E-01	9.79E-02	3.32E-01	3.79E-01	3.85E-01	3.10E-01	1.20E-01
Benzo[a]pyrene	2.91E+00	1.18E+00	3.36E-01	3.96E+00	4.05E-01	1.76E+00	1.61E+00	2.30E-01	6.64E-02	1.47E-01	2.07E-01	2.15E-01	1.73E-01	6.77E-02
Indeno[cd]pyrene	1.11E+00	2.05E-01	5.84E-02	1.62E+00	7.97E-02	6.15E-01	7.11E-01	8.30E-02	4.56E-04	7.07E-02	3.93E-02	7.59E-02	5.39E-02	3.42E-02
Benzo[ghi]perylene	1.31E-01	4.21E-02	1.20E-02	1.14E-02	4.25E-02	4.77E-02	4.89E-02	1.05E-02	2.90E-03	1.08E-02	4.58E-03	2.08E-03	6.17E-03	4.19E-03
Dibenzo[ah]anthracene	2.74E+00	7.30E-01	2.08E-01	4.49E+00	3.13E-01	1.70E+00	1.87E+00	1.29E-01	1.92E-02	1.85E-01	1.15E-01	1.60E-01	1.22E-01	6.35E-02
22,29,30-Trisnorhopane	1.57E+01	2.21E+01	6.30E+00	2.27E+01	8.71E+00	1.51E+01	7.50E+00	4.97E+00	2.56E+00	1.72E+00	3.81E+00	2.04E+00	3.02E+00	1.35E+00
17a(H),21b(H)-29-Norhopane	2.33E+00	4.03E+00	1.15E+00	7.11E+00	1.70E+00	3.26E+00	2.40E+00	1.35E+00	6.16E-01	5.80E-01	7.00E-01	3.55E-01	7.20E-01	3.74E-01
17a(H),21b(H)-Hopane	4.67E+01	6.64E+01	1.89E+01	9.38E+01	3.02E+01	5.12E+01	2.98E+01	2.89E+01	1.10E+01	6.92E+00	1.52E+01	8.66E+00	1.41E+01	8.81E+00
22S-17a(H),21b(H)-30-Homohopane	1.56E+01	2.47E+01	7.04E+00	3.44E+01	1.12E+01	1.86E+01	1.10E+01	9.97E+00	3.72E+00	2.84E+00	5.37E+00	3.03E+00	4.99E+00	2.96E+00
22R-17a(H),21b(H)-30-Homohopane	1.42E+01	2.41E+01	6.88E+00	3.43E+01	1.20E+01	1.83E+01	1.09E+01	9.73E+00	3.56E+00	2.84E+00	5.49E+00	2.87E+00	4.90E+00	2.91E+00
22S-17a(H),21b(H)-30-Bishomohopan	8.16E+00	1.67E+01	4.77E+00	2.56E+01	7.71E+00	1.26E+01	8.54E+00	6.87E+00	2.41E+00	1.81E+00	3.53E+00	1.89E+00	3.30E+00	2.11E+00
22R-17a(H),21b(H)-30-Bishomohopan	6.94E+00	1.19E+01	3.39E+00	1.77E+01	5.99E+00	9.18E+00	5.68E+00	6.07E+00	1.78E+00	1.38E+00	2.55E+00	1.39E+00	2.63E+00	1.98E+00

Table E-2. Daily PAH and hopane concentrations (ng/m^3) detected at the upwind sampling location.

	Week 1 Sampling Date						Week 2 Sampling Date						
Compound	02/22/00	02/23/00	02/24/00	02/25/00	Mean	SD	02/28/00	02/29/00	03/01/00	03/02/00	03/03/00	Mean	SD
Phenanthrene	2.19E+02	4.23E+01	6.71E+01	1.46E+02	1.18E+02	8.00E+01	1.27E+01	4.32E+01	9.78E+00	4.01E+01	9.49E+00	2.31E+01	1.70E+01
Anthracene	1.09E+01	2.35E+00	3.42E+00	6.10E+00	5.70E+00	3.83E+00	7.77E-01	1.87E+00	5.63E-01	1.87E+00	5.15E-01	1.12E+00	6.91E-01
Methyl-178PAH	4.05E+02	9.96E+01	1.36E+02	2.99E+02	2.35E+02	1.43E+02	2.82E+01	8.58E+01	2.04E+01	7.38E+01	2.13E+01	4.59E+01	3.14E+01
Dimethyl-178PAH	4.01E+02	1.18E+02	1.51E+02	2.83E+02	2.38E+02	1.30E+02	3.04E+01	9.30E+01	2.25E+01	6.29E+01	2.46E+01	4.67E+01	3.06E+01
Trimethyl-178PAH	3.59E+00	1.33E+00	1.72E+00	2.77E+00	2.35E+00	1.02E+00	3.11E-01	7.39E-01	2.04E-01	4.96E-01	1.87E-01	3.87E-01	2.32E-01
Fluoranthene	1.06E+02	3.44E+01	5.01E+01	6.58E+01	6.40E+01	3.05E+01	1.01E+01	2.48E+01	7.47E+00	1.38E+01	7.91E+00	1.28E+01	7.16E+00
Acephenanthrylene	1.85E+01	5.35E+00	7.33E+00	8.92E+00	1.00E+01	5.82E+00	1.56E+00	2.81E+00	9.23E-01	1.43E+00	7.56E-01	1.50E+00	8.10E-01
Pyrene	1.72E+02	5.83E+01	8.71E+01	1.11E+02	1.07E+02	4.85E+01	1.65E+01	4.50E+01	1.37E+01	2.33E+01	1.53E+01	2.28E+01	1.29E+01
Methyl-202PAH	1.16E+02	4.14E+01	5.22E+01	6.81E+01	6.95E+01	3.30E+01	1.13E+01	3.02E+01	9.88E+00	1.64E+01	1.27E+01	1.61E+01	8.28E+00
Dimethyl-202PAH	6.25E+01	2.44E+01	2.78E+01	3.29E+01	3.69E+01	1.74E+01	6.22E+00	1.46E+01	6.38E+00	8.95E+00	8.21E+00	8.87E+00	3.42E+00
Benzo[ghi]fluoranthene	1.75E+01	1.01E+01	1.06E+01	1.23E+01	1.26E+01	3.39E+00	2.28E+00	2.84E+00	1.80E+00	1.79E+00	1.96E+00	2.14E+00	4.44E-01
Benzo[a]anthracene	5.54E+00	3.37E+00	4.21E+00	2.77E+00	3.97E+00	1.20E+00	8.25E-01	8.64E-01	6.11E-01	4.59E-01	8.09E-01	7.13E-01	1.73E-01
Cyclopenta[cd]pyrene	9.24E+00	5.39E+00	5.91E+00	6.65E+00	6.79E+00	1.71E+00	9.49E-01	8.17E-01	8.78E-01	7.05E-01	6.72E-01	8.04E-01	1.16E-01
Chrysene+Triphenylene	1.18E+01	6.65E+00	7.02E+00	6.79E+00	8.07E+00	2.50E+00	1.64E+00	2.36E+00	1.38E+00	1.41E+00	1.83E+00	1.72E+00	4.01E-01
Benzo[k]fluoranthene	1.82E+00	2.22E+00	2.32E+00	8.28E-01	1.80E+00	6.81E-01	3.30E-01	1.79E-01	3.12E-01	7.87E-02	5.23E-01	2.85E-01	1.68E-01
Benzo[b]fluoranthene	1.58E+00	1.65E+00	1.89E+00	6.09E-01	1.43E+00	5.66E-01	2.85E-01	1.52E-01	2.15E-01	3.55E-02	4.27E-01	2.23E-01	1.46E-01
Benzo[j]fluoranthene	9.31E-01	5.50E-01	4.18E-01	9.22E-01	7.05E-01	2.61E-01	4.72E-01	4.00E-01	1.23E-01	3.74E-01	1.39E-01	3.01E-01	1.60E-01
Benzo[e]pyrene	2.83E+00	2.77E+00	2.72E+00	1.68E+00	2.50E+00	5.48E-01	5.22E-01	3.29E-01	4.52E-01	1.51E-01	6.53E-01	4.21E-01	1.91E-01
Benzo[a]pyrene	1.80E+00	1.89E+00	2.07E+00	9.16E-01	1.67E+00	5.16E-01	3.14E-01	1.73E-01	2.58E-01	4.14E-02	3.48E-01	2.27E-01	1.23E-01
Indeno[cd]pyrene	5.59E-01	7.59E-01	8.79E-01	2.25E-01	6.05E-01	2.86E-01	1.42E-01	3.76E-02	1.06E-01	2.18E-02	1.18E-01	8.50E-02	5.24E-02
Benzo[ghi]perylene	9.13E-04	5.29E-03	2.41E-02	1.13E-02	1.04E-02	1.01E-02	5.61E-03	6.38E-03	1.82E-03	1.71E-02	3.68E-03	6.91E-03	5.94E-03
Dibenzo[ah]anthracene	1.01E+00	1.94E+00	1.70E+00	9.98E-01	1.41E+00	4.81E-01	2.24E-01	6.23E-02	2.40E-01	6.10E-02	3.03E-01	1.78E-01	1.10E-01
22,29,30-Trisnorhopane	2.82E+01	1.16E+01	1.03E+01	1.61E+01	1.66E+01	8.15E+00	4.50E+00	6.98E+00	3.07E+00	4.51E+00	1.01E+00	4.01E+00	2.19E+00
17a(H),21b(H)-29-Norhopane	5.90E+00	2.73E+00	1.93E+00	3.34E+00	3.47E+00	1.72E+00	9.33E-01	1.51E+00	1.04E+00	1.19E+00	1.37E+00	1.21E+00	2.35E-01
17a(H),21b(H)-Hopane	8.21E+01	3.84E+01	3.55E+01	6.02E+01	5.40E+01	2.17E+01	1.76E+01	2.31E+01	1.13E+01	1.84E+01	1.07E+00	1.43E+01	8.49E+00
22S-17a(H),21b(H)-30-Homohopane	2.83E+01	1.59E+01	1.25E+01	2.18E+01	1.96E+01	6.95E+00	7.03E+00	9.02E+00	4.03E+00	6.48E+00	1.16E+01	7.64E+00	2.86E+00
22R-17a(H),21b(H)-30-Homohopane	2.82E+01	1.36E+01	1.18E+01	2.25E+01	1.90E+01	7.68E+00	6.79E+00	8.48E+00	4.06E+00	6.15E+00	3.57E+00	5.81E+00	2.02E+00
22S-17a(H),21b(H)-30-Bishomohopan	2.25E+01	1.10E+01	8.10E+00	1.41E+01	1.39E+01	6.23E+00	5.15E+00	5.43E+00	2.57E+00	4.53E+00	2.85E+00	4.10E+00	1.32E+00
22R-17a(H),21b(H)-30-Bishomohopan	1.29E+01	8.64E+00	6.04E+00	1.01E+01	9.41E+00	2.85E+00	3.62E+00	4.67E+00	2.00E+00	3.21E+00	1.85E+00	3.07E+00	1.17E+00