APPENDIX C

EXPERIMENTAL METHODS DETAIL

Table of Contents

TABLE C-1. TRANSIT BUS TESTING SCHEDULE 2
TABLE C-2. ENGINE ON/OFF TIMES 3
TABLE C-3. SUBROUTE START/END TIMES 4
TABLE C-3 *CONTINUED*. AVON SUBROUTE START/END TIMES 5
TABLE C-4. DILUTION RATIOS BY SUBROUTE 6
TABLE C-5. FRACTION OF EXHAUST SAMPLED FOR PM FILTER MASS (PERCENT). 10
TABLE C-6. PANEL MODE CALCULATION EXAMPLE 11
TABLE C-7. FILENAME PROTOCOLS FOR CTTRANSIT STUDY 15
TABLE C-8. PM GRAVIMETRIC MASS (MICROGRAMS) ON FILTERS 16
TABLE C-9. MEAN G/MI PM FILTER EMISSIONS DATA INTERACTION PLOT. 17
TABLE C-10. SMPS MEAN EMISSIONS (#/CM^3): ENFIELD. 18
TABLE C-11. SMPS MEAN EMISSIONS (#/CM^3): FARMINGTON 19
TABLE C-12. SMPS MEAN EMISSIONS (#/CM^3): AVON FULL ROUTE. 20
TABLE C-13. SMPS MEAN EMISSIONS (#/CM^3): AVON UPGRADE. 21
TABLE C-14. SMPS MEAN EMISSIONS (#/CM^3): AVON DOWNGRADE. 22
TABLE C-15. ELPI TPN (#/CM^3) STATISTICS BY BUS-ROUTE-FUEL. 23
TABLE C-16. ELPI TPN (#/CM^3) STATISTICS BY BUS TYPE-ROUTE-FUEL. 24
TABLE C-17. ELPI – SMPS CORRESPONDING STAGE-DIAMETER TABLE. 25
FIGURE C-1. ELPI (STAGE 1) – SMPS (10 NM) CORRESPONDENCE PLOT 25
FIGURE C-2. ELPI (STAGE 2) – SMPS (40 NM) CORRESPONDENCE PLOT 25
FIGURE C-3. ELPI (STAGE 3)– SMPS (80, 100 OR 130 NM) CORRESPONDENCE PLOT. 26
FIGURE C-4. ELPI (STAGE 4)– SMPS (130 NM) CORRESPONDENCE PLOT 26
FIGURE C-5. ELPI (TPN) – SMPS SCATTER PLOT AND TIME SERIES. 27
FIGURE C-6. FUEL SULFUR CONTENT AND G/MI PM EMISSION RATE. 27

TABLE C-1. Transit Bus Testing Schedule

Date	Bus	Driver	Fuel	After-treatment	Comments	Temp (°C)	RH (%)
6-Jan-04	H301	Ted	No. 1 diesel	DOC	First full run with final routes.	0.6	67
7-Jan-04	H301	Ted	No. 1 diesel	DOC	Idle tests only -- parking lot	-8.9	59
21-Jan-04	H301	Ted	No. 1 diesel	DOC	T is -2C@3:24pm	-5.6	48
23-Jan-04	201	Al	No. 1 diesel	DOC	No ELPI warm-up file.	-9.4	49
30-Jan-04	201	Ted	No. 1 diesel	DOC		-5	55
11-Feb-04	202	Ted	No. 1 diesel	DOC	Compressor brass joint failed - fixed at CTT. TB1 little high.	1.1	52
13-Feb-04	202	Ted	No. 1 diesel	DOC	Compressor failed 2X; no Avon/Farm IN; no TB2.		
18-Feb-04	202	Ted	No. 1 diesel	DOC	Two Full Route Runs; New Mag & Intersection Logsheets. Horiba GPS not working.	-1.1 2.8	64 50
27-Feb-04	H302	Ted	No. 1 diesel	DOC	New flowmeter swagelok for mini-diluter.	7.2	20
16-Apr-04	H301	Jimmy	No. 1 diesel	DOC	New Zeroing protocol (Horiba); Exhaust pipe extension; new bracket, longer plate. New subRoutes for PMFilter mass measurement. VANSCO scantool first use.	16.1	14
21-Apr-04	H301	Jimmy	No. 1 diesel	DOC	Synchronize clocks to Fugawi GPS software. HOV lane closed on 91S.	17.8	24
23-Apr-04	201	Jimmy	No. 1 diesel	DOC	Light rain.	8.9	83
28-Apr-04	202	Jimmy	No. 1 diesel	DOC	Problem with Prolink laptop on warm-up.	11.1	35
30-Apr-04	H302	Jimmy	No. 1 diesel	DOC	New Husky Compressor	25	39
26-May-04	202	Jimmy	No. 1 diesel	DOC	Husky Compressor. SMPS cannot maintain aerosol flowrate. Light mist.	12.2	87
27-May-04	202	Jimmy	No. 1 diesel	DOC	Husky Compressor. Leak in boost (Avon Out).	22.8	59
28-May-04	H301	Jimmy	No. 1 diesel	DOC	Humidity problems with mini-diluter. Husky. Medium rain. Dessicant saturated.	16.7	90
2-Jun-04	H301	Jimmy	No. 1 diesel	DOC	ENFIELD ONLY. Stop sampling due to water. Husky.	22.8	57
29-Jun-04	202	Jimmy	ULSD	DOC	Sears compressor returned. New NOx sensor. New condenser traps and line flushing procedure.	23.9	42
29-Jul-04	H301	Jimmy	ULSD	DOC	ELPI pump died, no ELPI data.	28.9	49
3-Aug-04	H301	Jimmy	ULSD	DOC	New SV25B ELPI pump	29.4	63
4-Aug-04	H301	Jimmy	ULSD	DOC	Mag2 problem - minidiluter	29.4	42
6-Aug-04	201	Jimmy	ULSD	DOC	Lost Horiba power, returned to CTT; extra enging off. No Prolink for Enfield Outbound.	22.8	40
10-Aug-04	201	Jimmy	ULSD	DOC	Wrong turn on Farmington Inbound, 11:32-11:41. Reboot Prolink engine time before Avon Inbound.	29.4	45
25-Aug-04	H302	Jimmy	ULSD	DOC	New ELPI valve.	23.9	45
26-Aug-04	H302	Jimmy	ULSD	DOC		25	45
20-Sep-04	202	Jimmy	ULSD	DOC	Bus transmission problem (noise).	18.3	45
21-Sep-04	202	Jimmy	ULSD	DOC	Mag problems with minidiluter. Problems with Prolink files.	21.1	49
12-Oct-04	H301	Jimmy	ULSD	DOC + DPF	Hybrid Consortium -- No Enfield Run	15.6	44
13-Oct-04	H301	Jimmy	ULSD	DOC + DPF		18.9	33
15-Oct-04	H301	Jimmy	ULSD	DOC + DPF	Infrared measurements end of day	13.3	93
20-Oct-04	201	Jimmy	ULSD	DOC + DPF	problem with Mag	11.7	59
25-Oct-04	201	Jimmy	ULSD	DOC + DPF	problem with Tee thermocouple	11.7	57
2-Nov-04	H302	Jimmy	ULSD	DOC + DPF	Andersen Pump fuse blew. First TB3 collection.	8.3	71
3-Nov-04	H302	Jimmy	ULSD	DOC + DPF		11.7	45
9-Nov-04	202	Jimmy	ULSD	DOC + DPF	Labview Recording problem- Mag resistor	3.9	25
10-Nov-04	202	Jimmy	ULSD	DOC + DPF	Labview Recording problem- Mag resistor	0.6	42
16-Nov-04	H301	Jimmy	ULSD	DOC + DPF	EEPS. Belt problem on bus = excess vibration	8.3	61
17-Nov-04	H301	Jimmy	ULSD	DOC + DPF	EEPS. Belt problem on bus = excess vibration	8.9	58

Table C-2. Engine ON/OFF Times

	Warm Up		Enfield				Farmington				Avon			
	On	Off	Out On	Out Off	In On	In Off	Out On	Out Off	In On	In Off	Out On	Out Off	In On	In Off
6-Jan			13:25:17	13:44:31	NA	14:28:26	14:28:32	15:00:01	16:03:57	16:35:58	15:09:09	15:32:39	15:44:07	16:03:57
7-Jan			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21-Jan			15:11:00	15:33:16	15:33:16	15:54:35	16:00:56	16:32:42	17:31:25	18:01:45	16:39:05	17:01:11	17:06:42	17:31:25
23-Jan			14:05:44	14:25:47	14:27:00	14:51:41	15:19:27	15:51:30	16:42:11	17:12:37	15:51:30	16:13:14	16:20:31	16:42:10
30-Jan			11:47:33	12:06:20	12:06:21	12:30:18	12:39:57	13:08:14	14:06:48	14:35:52	13:13:08	13:34:21	13:46:24	14:06:48
11-Feb			11:52:03	12:21:00	12:21:00	12:38:35	12:50:44	13:22:00	14:22:48	14:59:07	13:24:15	13:52:39	14:04:09	14:22:47
13-Feb			12:12:54	12:31:34	12:40:23	12:57:30	13:02:28	13:36:40	14:35:51	15:07:44	13:39:36	14:00:33	14:11:09	NA
18-Feb			10:02:39	engine not turned off		10:45:32	10:50:48	11:25:33	12:34:07	13:07:21	11:26:01	11:51:40	12:11:50	12:34:06
18-Feb *2			13:14:10	engine not turned off		13:58:37	14:07:13	14:38:10	15:24:28	15:54:58	14:38:10	14:59:00	15:05:23	15:24:28
27-Feb			12:03:15	engine not turned off		12:48:37	12:58:24	13:30:24	14:33:00	15:08:04	13:35:25	13:55:23	14:11:16	14:31:35
16-Apr			11:25:34	11:47:55	11:58:47	12:19:53	12:31:41	13:06:47	14:31:00	15:07:44	13:19:09	13:39:50	14:01:36	14:21:33
21-Apr			10:58:44	11:23:17	11:33:19	11:56:23	12:06:26	12:38:16	13:56:04	14:30:18	12:47:57	13:07:51	13:23:34	13:47:05
23-Apr			12:47:41	13:07:11	13:23:34	13:44:24	13:58:34	14:27:58	15:49:49	16:16:57	14:38:52	15:02:50	15:19:26	15:40:59
28-Apr			11:06:04	11:34:34	11:43:48	12:03:59	12:13:44	12:40:19	13:54:18	14:24:13	12:49:17	13:08:44	13:24:04	13:45:21
30-Apr			12:40:05	13:02:19	NA	13:30:21	13:39:07	14:11:30	15:27:18	15:58:38	14:18:08	14:31:16	14:58:08	15:18:39
26-May			11:38:17	12:00:32	12:09:07	12:29:13	12:40:36	13:09:29	14:33:27	15:01:54	13:18:22	NA	13:59:08	14:23:33
27-May			10:17:52	10:40:26	10:47:38	11:06:46	11:12:37	11:43:04	13:08:33	NA	11:51:14	NA	12:37:22	13:00:51
28-May			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Jun			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-Jun			12:22:50	12:45:08	13:00:12	13:21:23	13:29:34	13:57:52	15:22:10	15:49:07	14:06:41	14:29:11	14:53:23	15:14:44
29-Jul	11:01:23	11:20:20	11:38:53	12:03:29	12:18:14	12:38:58	12:46:47	13:15:25	14:29:48	14:55:55	13:21:20	13:40:21	14:02:08	14:23:18
3-Aug	11:45:16	12:03:34	12:11:09	12:35:18	12:41:03	13:02:24	13:09:48	13:39:24	14:51:49	15:19:58	13:46:11	14:05:28	14:23:49	14:45:10
4-Aug	11:31:32	11:50:05	11:59:33	12:23:26	12:29:46	12:49:59	12:55:15	13:25:15	14:48:07	15:18:45	13:31:45	13:55:20	14:17:46	14:42:18
6-Aug	10:51:50	11:10:09	11:16:46	11:39:48	11:48:07	12:13:43	12:30:12	13:03:22	14:26:12	14:55:29	13:22:23	13:41:21	13:57:09	14:21:20
10-Aug	10:08:41	10:26:45	10:32:25	10:55:47	11:01:03	11:21:26	11:26:42	12:07:55	13:42:12	14:11:10	12:13:58	12:35:04	13:15:24	13:37:07
25-Aug	9:58:54	10:17:00	10:23:34	10:45:56	10:52:24	11:12:25	11:18:07	11:45:14	13:01:18	13:34:14	11:50:55	12:12:35	12:32:27	12:55:13
26-Aug	9:39:10	9:56:53	10:02:39	10:26:03	10:34:03	10:53:38	10:59:02	11:27:14	12:41:59	13:11:24	11:32:34	11:52:57	12:13:45	12:37:09
20-Sep	9:05:32	9:25:48	9:32:47	9:54:13	9:59:50	10:18:38	10:24:14	10:53:05	12:12:27	12:40:28	10:59:00	11:20:25	11:44:13	12:07:08
21-Sep	8:27:00	8:45:04	8:50:31	9:12:00	9:17:19	9:35:51	9:42:13	10:11:01	11:35:07	12:04:07	10:16:11	10:35:05	11:01:52	11:27:10
12-Oct	9:02:44	9:27:46	Not driven this day				9:34:50	10:05:19	11:18:58	11:51:36	10:12:06	10:31:54	10:49:05	11:13:00
13-Oct	9:27:08	9:44:07	9:50:10	10:12:13	10:18:05	10:36:58	10:49:29	11:17:31	12:33:36	13:05:06	11:24:14	11:44:01	12:05:02	12:27:55
15-Oct	8:50:36	9:09:16	9:14:36	9:36:19	9:42:27	10:02:40	10:08:10	10:37:20	11:49:00	12:17:16	10:42:55	11:03:27	11:20:51	11:43:39
20-Oct	8:48:20	9:07:37	9:13:15	9:35:16	9:41:35	10:00:24	10:07:39	10:37:02	11:45:34	12:18:55	10:42:26	11:01:55	11:18:08	11:40:32
25-Oct	9:13:16	9:30:30	9:35:57	9:57:36	10:03:05	10:21:54	10:27:47	10:54:18	12:03:49	12:34:50	10:59:33	11:18:12	11:36:38	11:58:18
2-Nov	8:46:13	9:05:33	9:11:45	9:41:54	9:47:06	10:06:51	10:12:12	10:42:10	12:05:29	12:38:34	10:47:05	11:06:57	11:39:19	12:00:09
3-Nov	9:00:34	9:18:36	9:24:16	9:46:57	9:52:14	10:11:48	10:17:41	10:46:46	12:18:16	12:48:00	10:52:17	11:12:46	11:50:04	12:12:17
9-Nov	9:13:37	9:37:45	9:43:30	10:04:41	10:12:21	10:31:46	10:37:00	11:06:21	12:38:25	13:10:27	11:12:03	11:34:12	12:10:18	12:32:42
10-Nov	9:12:54	9:30:17	9:35:46	9:57:19	10:02:52	10:21:46	10:26:42	10:54:51	12:25:47	12:56:11	11:00:23	11:18:43	11:57:48	12:20:00
16-Nov	9:06:07	9:23:54	9:31:10	9:51:14	9:58:52	10:18:46	10:30:05	10:58:17	12:35:00	13:06:42	11:04:00	11:25:32	12:03:11	12:27:52
17-Nov	9:10:41	9:28:36	9:35:57	10:01:48	10:08:15	10:27:37	10:33:35	11:02:08	12:36:35	13:08:39	11:08:54	11:29:29	12:09:21	12:30:30

Table C-3. Subroute START/END Times

Date	Warm Up				Enfield				Farmington			
	Out start	Out End	In start	In End	Out start	Out End	In start	In End	Out start	Out End	In start	In End
6-Jan	12:35:20	12:44	12:45:45	12:57:14	13:28:46	13:44:31	13:52:25	14:09:32	14:38:03	14:57:43	16:03:57	16:22:14
7-Jan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21-Jan	NA	14:49	NA	15:01:53	15:15	15:27:37	15:40:00	15:53:48	16:17:47	16:32:17	17:31:25	17:56:00
23-Jan	13:50	NA	13:53:36	14:00	14:11	14:25:47	14:34:15	14:49:59	15:33:09	15:51:30	16:42:11	16:56:09
30-Jan	11:23:16	11:29:51	11:31:20	11:37:24	11:50:37	12:05:40	12:13:20	12:29:41	12:50:22	13:08:14	14:06:48	14:25:30
11-Feb	11:29	11:36	11:37	11:44	11:56	12:11:33	12:21:45	12:37:03	13:00:11	13:21:59	14:22:47	14:45:50
13-Feb	11:03:59	11:10:19	11:11:47	11:18:38	12:15:57	12:31:34	12:40:59	12:56:30	13:13:09	13:35:10	13:35:52	14:53:55
18-Feb	9:36:23	9:46:50	9:50:59	9:54:10	10:04:55	10:20:01	10:28:12	10:45:21	11:00:48	11:25:32	12:30:00	13:01:42
18-Feb *2	NA	NA	NA	NA	13:16	13:32:21	13:41	13:57	14:15	14:37	15:24:28	15:43
27-Feb	11:38:36	NA	11:46:20	11:53:55	12:06:35	12:22:19	12:30:57	12:48:22	13:08:56	13:29:52 PM	14:33:00	14:56:40
16-Apr	11:00:51	11:06:00	11:08:14	11:14:27	11:28:40	11:43:45	12:03:30	12:18:49	12:41:00	13:06:00	14:31:00	14:48:20
21-Apr	10:31:28	10:37:55	10:39:20	10:48:05	11:01:33	11:17:40	11:36:14	11:56:09	12:18:39	12:36:59	13:56:04	14:14:21
23-Apr	12:21:15	12:27:20	12:29:29	12:36:00	12:51:50	13:07:32	13:27:38	13:43:50	14:06:54	14:24:12	15:49:49	NA
28-Apr	10:32:56	10:44:43	10:45:58	10:53:39	11:16:50	11:32:00	11:47:25	12:02:08	12:22:29	12:40:26	13:54:22	14:12:12
30-Apr	12:13:14	12:19:38	12:21:32	12:28:53	12:43:08	12:58:01	13:12:52	13:30:21	13:47:00	14:10:50	15:27:18	15:43:38
26-May	11:09:15	11:15:30	11:16:50	11:24:50	11:42:25	11:57:25	12:13:50	12:28:04	12:49:50	13:08:38	14:33:27	14:50:30
27-May	9:56:57	10:03:16	10:04:17	10:10:47	10:21:12	10:34:40	10:50:02	11:06:28	11:20:58	11:42	13:08:33	13:30:04
28-May	10:36:30	10:43:23	10:45:24	10:52:36	11:06:21	11:22:07	12:00:41	12:19:13	13:02:30	13:20:31	NA	NA
2-Jun	10:17:16	10:23:43	10:24:46	10:31:40	10:47:35	11:02:18	11:16:54	NA	NA	NA	NA	NA
29-Jun	11:53:10	11:59:17	12:01:22	12:07:56	12:25:50	12:40:50	13:04:53	13:20:25	NA	NA	15:22:10	14:47:00
29-Jul	11:05:10	11:11:15	11:12:46	11:20:17	11:42:30	11:58:40	12:22:00	12:38:53	12:46:47	13:14:50	14:27:31	14:55:55
3-Aug	11:47:34	11:54:00	11:56:00	12:03:25	12:14:28	12:29:48	12:44:50	13:02:12	13:19:42	13:38:38	14:51:49	15:08:29
4-Aug	11:34:10	11:40:33	11:42:40	11:49:59	12:02:45	12:18:32	12:33:17	12:49:54	13:05:49	13:23:20	14:48:07	15:06:30
6-Aug	10:55:00	11:01:20	11:02:40	11:09:58	11:19:47	11:35:44	11:51:42	12:08:26	12:39:24	13:02:33	14:26:12	14:47:34
10-Aug	10:11:51	10:17:46	10:14:18	10:26:21	10:35:44	10:51:20	11:04:15	10:21:15	11:44:18	12:06:59	13:42:12	14:04:10
25-Aug	10:01:26	10:08:15	10:09:42	10:16:52	10:26:18	10:41:38	10:55:32	11:11:50	11:26:29	11:44:26	13:01:18	13:20:15
26-Aug	9:41:21	9:47:35	9:49:33	9:56:54	10:05:22	10:20:36	10:36:44	10:53:31	11:07:44	11:26:27	12:41:59	12:58:48
20-Sep	9:09:45	9:16:05	9:18:26	9:25:28	9:35:38	9:50:34	10:02:14	10:18:30	10:30:30	10:52:26	12:12:27	12:32:47
21-Sep	8:30:49	8:35:59	8:38:22	8:44:53	8:53:09	9:07:35	9:19:58	9:35:45	9:49:24	10:10:25	11:35:07	11:51:03
12-Oct	9:12:56	9:19:11	9:20:31	9:27:36	NA	NA	NA	NA	9:43:50	10:04:34	11:18:58	11:35:34
13-Oct	9:29:30	9:35:58	9:37:04	9:43:50	9:53:33	10:08:56	10:20:33	10:36:48	10:58:15	11:17:20	12:33:36	12:52:17
15-Oct	8:54:38	9:01:13	9:02:11	9:09:03	9:17:08	9:32:02	9:45:40	10:02:28	10:16:55	10:36:42	11:49:00	12:05:16
20-Oct	8:52:56	8:59:15	9:00:51	9:07:23	9:15:44	9:30:35	9:44:03	9:59:53	10:17:00	10:34:54	11:45:34	12:07:16
25-Oct	9:15:33	9:21:43	9:23:09	9:30:00	9:38:30	9:53:11	10:05:45	10:21:24	10:35:34	10:53:39	12:03:49	12:21:48
2-Nov	8:50:17	8:56:30	8:58:21	9:05:28	9:23:10	9:38:11	9:50:02	10:06:44	10:21:59	10:41:33	12:05:29	12:24:56
3-Nov	9:03:45	9:10:12	9:11:13	9:18:11	9:27:01	9:42:13	9:55:02	10:11:38	10:25:53	10:45:45	12:18:16	12:36:45
9-Nov	9:23:17	9:29:28	9:30:05	9:37:46	9:46:37	10:01:09	10:15:30	10:31:30	10:46:56	11:05:46	12:38:25	12:54:58
10-Nov	9:16:08	9:22:14	9:23:21	9:30:10	9:38:27	9:52:58	10:05:15	10:21:15	10:36:48	10:54:13	12:25:47	12:42:32
16-Nov	9:09:27	9:15:45	9:16:48	9:23:55	9:33:43	9:48:20	10:01:51	10:18:40	10:37:29	10:57:27	12:35:00	12:58:14
17-Nov	9:13:30	9:21:31	9:27:28	9:21:31	9:39:15	9:58:17	10:11:35	10:26:55	10:40:59	11:01:30	12:36:35	12:54:50

Table C-3 *continued*. Avon Subroute START/END Times

Avon				Avon (uphill)				Avon (downhill)			
Out start	Out End	In start	In End	Up out start	Up out End (top)	Up back start	Up back End (top)	Down out start	Down out End (Nod Rd)	Down start back	Down End back (Mtn Rd)
15:09:09	15:32:39	15:44:07	16:03:57	15:19:17	15:20:59	15:51:14	~ 15:52:00	15:21:00	15:24:54	~ 15:52:00	16:03:57
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16:39:05	17:01:11	17:06:42	17:31:25	16:46:06	16:51:42	17:14:59	17:17:43	16:51:42	16:53:34	17:17:43	17:20:47
15:51:30	16:13:14	16:20:31	16:42:10	16:01:07	16:04:43	16:27:00	16:30:19	16:04:43	16:06:37	16:30:19	16:32:48
13:13:08	13:34:21	13:46:24	14:06:48	13:20:52	13:24:25	13:52:56	13:55:50	13:24:25	13:26:06	13:55:50	13:57:30
13:24:15	13:52:39	14:04:09	14:22:47	13:40:13	13:43:27	14:10:54	14:13:28	13:43:27	13:45:33	14:13:28	14:16:14
13:39:36	14:00:33	14:11:09	NA	13:48:19	13:51:40	14:17:44	NA	13:51:40	13:54:29	NA	NA
11:26:01	11:51:40	12:11:50	12:34:06	11:38:40	11:41:52	12:19:37	12:22:00	11:41:52	11:44:02	12:22:00	12:24:40
14:38:10	14:59:00	15:05:23	15:24:28	14:47:58	14:51	15:11:35	15:14:14	14:51:00	14:53:11	15:14:14	15:16:45
13:35:25	13:55:23	14:11:16	14:31:35	13:43:32	13:46:30	14:18:20	14:21:07	13:46:30	13:48:41	14:21:07	14:24:20
13:19:09	13:39:50	14:01:36	14:21:33	13:25:52	13:30:30	14:06:24	14:09:02	13:30:30	13:32:30	14:09:02	14:12:36
12:47:57	13:07:51	13:23:34	13:47:05	12:55:38	12:59:05	13:30:07	13:32:51	12:59:05	13:01:03	13:32:51	13:37:20
14:38:52	15:02:50	15:19:26	15:40:59	14:51:30	14:52:26	15:27:00	15:29:49	14:52:26	14:54:52	15:29:49	15:33:00
12:49:17	13:08:44	13:24:04	13:45:21	12:57:55	13:00:44	13:30:53	13:33:20	13:00:44	13:02:47	13:33:20	13:36:37
14:18:08	14:31:16	14:58:08	15:18:39	14:26:10	14:30:25	15:04:01	15:06:41	14:30:25	NA	15:06:41	NA
13:18:22	NA	13:59:08	14:23:33	13:26:49	13:29:30	14:08:53	NA	13:29:30	13:32:15	NA	14:11:55
11:51:14	NA	12:37:22	13:00:51	12:01:10	12:03:42	12:44:40	12:47:00	12:03:42	12:05:58	12:47:00	12:49:03
NA	NA	NA	NA	13:38:40	13:41:43	NA	14:21:30	13:41:43	NA	14:21:30	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14:06:41	14:29:11	14:53:23	15:14:44	14:16:15	14:19:15	15:00:30	15:02:40	14:19:15	NA	15:02:40	NA
13:21:20	13:40:21	14:02:08	14:23:18	13:28:20	13:31:30	14:08:38	14:10:49	13:31:30	NA	14:10:49	14:13:26
13:46:11	14:05:28	14:23:49	14:45:10	13:53:44	13:56:53	14:30:56	14:33:06	13:56:53	13:59:54	14:33:06	14:35:48
13:31:45	13:55:20	14:17:46	14:42:18	13:42:40	13:46:00	14:26:46	14:29:24	13:46:00	NA	14:29:24	14:32:50
13:22:23	13:41:21	13:57:09	14:21:20	13:27:03	13:30:08	14:05:06	14:06:58	13:30:08	13:32:30	14:06:58	14:10:03
12:13:58	12:35:04	13:15:24	13:37:07	12:22:11	12:25:45	13:21:16	13:23:45	12:25:45	12:27:48	13:23:45	13:26:32
11:50:55	12:12:35	12:32:27	12:55:13	11:58:40	12:01:47	12:39:56	12:41:41	12:01:47	12:04:33	12:41:41	12:45:58
11:32:34	11:52:57	12:13:45	12:37:09	11:40:32	11:43:23	12:20:45	12:23:20	11:43:23	11:46:15	12:23:20	12:26:21
10:59:00	11:20:25	11:44:13	12:07:08	11:07:07	11:10:07	11:51:36	11:53:48	11:10:07	11:13:06	11:53:48	11:56:40
10:16:11	10:35:05	11:01:52	11:27:10	10:23:03	10:26:16	11:09:28	11:12:05	10:26:16	10:28:33	11:12:05	11:14:41
10:12:06	10:31:54	10:49:05	11:13:00	10:19:51	10:22:57	10:57:10	10:59:31	10:22:57	10:25:00	10:59:31	11:02:49
11:24:14	11:44:01	12:05:02	12:27:55	11:31:40	11:34:32	12:11:00	12:13:43	11:34:32	11:36:38	12:13:43	12:16:00
10:42:55	11:03:27	11:20:51	11:43:39	10:51:00	10:53:56	11:27:00	11:29:30	10:53:56	10:56:29	11:29:30	11:32:41
10:42:26	11:01:55	11:18:08	11:40:32	10:49:38	10:52:25	11:24:20	11:26:51	10:52:25	10:54:27	11:26:51	11:29:29
10:59:33	11:18:12	11:36:38	11:58:18	11:06:06	11:09:26	11:42:49	11:45:29	11:09:26	11:12:11	11:45:29	11:47:48
10:47:05	11:06:57	11:39:19	12:00:09	10:55:04	10:58:01	11:45:55	11:48:33	10:58:01	11:03:04	11:48:33	11:51:05
10:52:17	11:12:46	11:50:04	12:12:17	10:58:28	11:01:26	11:56:05	11:58:38	11:01:26	11:03:00	11:58:38	12:01:15
11:12:03	11:34:12	12:10:18	12:32:42	11:22:15	11:25:17	12:16:15	12:18:44	11:25:17	11:27:25	12:18:44	12:21:05
11:00:23	11:18:43	11:57:48	12:20:00	11:07:12	11:10:05	12:05:38	12:08:40	11:10:05	11:12:14	12:08:40	12:10:35
11:04:00	11:25:32	12:03:11	12:27:52	11:11:28	11:14:30	12:09:51	12:12:39	11:14:30	11:16:23	12:12:39	12:15:26
11:08:54	11:29:29	12:09:21	12:30:30	11:16:19	11:19:12	12:14:06	12:16:49	11:19:12	11:21:15	12:16:49	12:20:00

Table C-4. Dilution Ratios by Subroute

DRA = Dilution Ratios for Diluter A (SMPS and ELPI)

Date		route										
		avon back down	avon back up	avon out down	avon out up	enfield in	enfield out	Farm in	Farm out	warm in	warm out	Total (all routes)
21-Jan-2004	Mean	28	28	28	28	28	28	28	28	28	28	28
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23-Jan-2004	Mean	27	27	27	27	27	27	27	27	27	27	27
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30-Jan-2004	Mean	31	31	31	31	31	31	31	31	31	31	31
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11-Feb-2004	Mean	31	31	31	31	31	31	31	31	31	31	31
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13-Feb-2004	Mean	30	30	30	30	30	30	30	30	30	30	30
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-Feb-2004	Mean	27	28	27	27	27	27	28	27	27	28	27
	Std. Deviation	1.2	1.2	1.4	0.7	1.6	1.8	1.0	1.1	0.3	0.4	1.3
18-Feb-2004	Mean	26	26	26	26	26	26	26	26			26
	Std. Deviation	0.8	0.4	0.7	0.5	0.8	0.6	0.8	0.8			0.8
27-Feb-2004	Mean	26	26	27	27	26	26	27	27	26	26	27
	Std. Deviation	0.1	0.1	0.3	0.2	0.4	0.4	0.6	0.4	0.3	0.6	0.7
16-Apr-2004	Mean	28	27	27	27	26	26	28	27	26	26	27
	Std. Deviation	6.5	6.0	6.2	6.0	6.0	6.1	6.4	6.1	6.1	5.6	6.2
21-Apr-2004	Mean	27	26	27	26	27	28	27	27	28	28	27
	Std. Deviation	6.0	5.9	6.1	5.7	6.4	6.3	6.1	6.3	6.5	6.7	6.3
23-Apr-2004	Mean	24	22	22	22	22	23	22	23	23	24	23
	Std. Deviation	5.3	5.4	5.3	5.4	5.4	5.5	5.5	5.5	5.8	5.9	5.6
28-Apr-2004	Mean	23	22	24	24	23	23	23	24	23	24	23
	Std. Deviation	5.6	5.5	5.2	5.2	5.5	5.4	5.3	5.6	5.7	5.6	5.5
30-Apr-2004	Mean	25	23	24	24	25	25	25	25	26	28	25
	Std. Deviation	5.4	5.7	5.1	5.7	5.9	6.0	5.9	6.4	6.2	6.4	6.1
26-May-2004	Mean	22	23	23	22	23	23	23	24	24	23	23
	Std. Deviation	5.7	5.1	5.5	5.3	5.4	5.6	5.3	5.6	5.5	5.7	5.5
27-May-2004	Mean	24	23	24	24	22	22	23	23	23	23	23
	Std. Deviation	6.0	5.6	5.8	5.8	4.8	4.9	5.5	5.3	5.2	5.1	5.3
28-May-2004	Mean					33	25		33	26	27	30
	Std. Deviation					7.6	5.4		6.3	4.3	3.7	7.2
2-Jun-2004	Mean					36	36			34	34	35
	Std. Deviation					8.5	8.7			8.3	8.2	8.5

Continued on next page…

29-Jun-2004	Mean	25	28	28	27	28	28	26	27	28	28	27
	Std. Deviation	7.3	7.1	6.6	7.1	7.3	7.3	6.7	7.2	7.5	7.3	7.2
29-Jul-2004	Mean	26	25	25	25	26	27	26	27	29	28	27
	Std. Deviation	7.6	7.4	8.0	7.2	8.2	7.5	8.6	9.2	7.3	6.3	8.3
3-Aug-2004	Mean	26	25	25	24	28	27	24	26	26	27	26
	Std. Deviation	7.5	7.1	8.0	7.6	8.6	8.1	9.6	8.6	8.7	7.9	8.7
4-Aug-2004	Mean	25	23	24	24	25	25	25	25	25	24	25
	Std. Deviation	7.5	6.9	7.0	7.2	7.9	7.9	8.0	8.5	8.9	7.7	8.0
6-Aug-2004	Mean	26	25	26	26	27	28	26	25	28	53	28
	Std. Deviation	6.5	6.2	6.8	6.7	7.0	7.5	6.9	6.6	7.3	24.5	11.0
10-Aug-2004	Mean	28	27	29	27	29	29	27	28	30	29	28
	Std. Deviation	6.0	6.4	5.8	6.4	6.7	6.7	6.3	6.4	6.7	6.5	6.5
25-Aug-2004	Mean	29	27	29	28	30	30	29	30	31	31	30
	Std. Deviation	6.2	6.3	6.3	6.1	6.6	6.6	6.7	6.7	6.6	6.4	6.6
26-Aug-2004	Mean	26	26	28	27	28	28	27	29	30	29	28
	Std. Deviation	6.1	5.9	6.3	5.9	6.6	6.4	6.8	6.5	6.8	6.4	6.6
20-Sep-2004	Mean	30	31	31	32	31	31	31	31	32	31	31
	Std. Deviation	6.6	6.4	6.2	6.1	6.3	6.4	7.1	6.2	6.3	6.3	6.5
21-Sep-2004	Mean	29	30	30	30	29	29	29	30	29	27	29
	Std. Deviation	6.0	5.1	5.6	5.8	6.0	5.8	5.6	5.9	5.4	5.9	5.8
13-Oct-2004	Mean	28	27	27	27	28	28	28	28	27	26	27
	Std. Deviation	6.1	6.0	6.2	5.9	6.2	6.2	6.4	6.2	6.1	6.1	6.2
15-Oct-2004	Mean	29	27	28	28	28	27	27	28	28	28	28
	Std. Deviation	6.1	6.3	6.3	6.1	6.5	6.4	8.1	6.4	6.3	6.4	6.8
20-Oct-2004	Mean	26	26	27	27	26	26	25	27	26	26	26
	Std. Deviation	6.6	6.5	6.5	6.5	6.7	6.7	7.6	6.8	6.8	6.6	7.0
25-Oct-2004	Mean	32	31	32	32	33	33	31	33	33	33	32
	Std. Deviation	8.4	8.0	8.5	8.3	8.4	8.4	9.6	8.4	8.2	8.3	8.7
2-Nov-2004	Mean	22	21	22	21	22	22	22	22	22	22	22
	Std. Deviation	5.7	5.8	5.7	5.5	5.5	5.7	6.3	5.7	5.6	5.7	5.8
3-Nov-2004	Mean	21	21	22	21	22	22	21	22	22	22	22
	Std. Deviation	5.0	5.1	5.4	5.7	5.4	5.6	6.3	5.5	5.4	5.5	5.7
9-Nov-2004	Mean	26	26	27	27	27	27	25	27	27	27	26
	Std. Deviation	0.4	0.3	0.4	0.4	0.4	0.4	4.0	0.4	0.4	0.4	2.2
10-Nov-2004	Mean	27	27	27	27	26	27	26	26	27	27	26
	Std. Deviation	0.3	0.3	0.3	0.3	0.3	0.3	4.6	0.3	0.3	0.3	2.3
16-Nov-2004	Mean	28	28	29	28	29	29	28	29	29	29	29
	Std. Deviation	0.8	0.7	1.0	1.1	1.1	1.1	3.2	0.9	1.2	1.1	2.0
17-Nov-2004	Mean	28	28	29	28	29	29	28	29	24	28	28
	Std. Deviation	0.7	0.7	0.7	0.8	1.0	1.0	4.1	0.6	9.6	1.0	3.1
Total (all dates)	Mean	26	26	26	26	27	27	26	27	27	28	27
	Std. Deviation	6.1	5.9	6.3	6.1	6.8	6.6	6.7	6.5	6.9	8.7	6.8

Continued on next page…

DRB = Dilution Ratios for Diluter B (PM Filter and 3-DRUM)

Date		route										
		avon back down	avon back up	avon out down	avon out up	enfield in	enfield out	Farm in	Farm out	warm in	warm out	Total (all routes)
21-Jan-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23-Jan-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30-Jan-2004	Mean	22	22	22	22	22	22	22	22	22	22	22
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11-Feb-2004	Mean	33	33	33	33	33	23	33	33	23	23	31
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13-Feb-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-Feb-2004	Mean	25	25	25	25	25	26	25	25	26	26	25
	Std. Deviation	0.5	0.4	0.4	0.4	0.4	0.5	0.3	0.3	0.3	0.4	0.5
18-Feb-2004	Mean	25	24	25	24	25	25	25	25			25
	Std. Deviation	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.3			0.4
27-Feb-2004	Mean	23	23	23	23	23	24	23	23	24	24	23
	Std. Deviation	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
16-Apr-2004	Mean	22	21	22	21	12	22	21	21	21	21	20
	Std. Deviation	0.9	1.1	1.0	1.0	9.9	0.9	1.1	1.0	1.0	3.2	5.4
21-Apr-2004	Mean	21	21	21	21	21	22	21	21	22	22	21
	Std. Deviation	0.9	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1
23-Apr-2004	Mean	22	22	22	21	21	22	22	22	22	22	22
	Std. Deviation	0.7	1.0	0.9	0.9	1.1	1.1	0.8	0.8	1.2	1.0	1.0
28-Apr-2004	Mean	21	21	21	21	21	21	21	21	21	21	21
	Std. Deviation	0.7	0.7	0.9	0.7	0.7	0.8	0.8	0.7	0.8	0.8	0.8
30-Apr-2004	Mean	21	21	21	21	21	21	21	21	22	21	21
	Std. Deviation	0.8	0.8	0.7	0.9	0.8	0.8	0.9	2.4	0.8	0.8	1.4
26-May-2004	Mean	21	21	21	21	21	21	21	21	22	22	21
	Std. Deviation	1.0	1.0	1.0	1.1	0.9	0.9	1.0	1.0	0.9	0.9	1.0
27-May-2004	Mean	21	21	21	21	21	21	21	21	21	21	21
	Std. Deviation	0.8	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.9
28-May-2004	Mean					21	21		21	21	21	21
	Std. Deviation					1.0	1.4		1.1	1.0	0.9	1.1
2-Jun-2004	Mean					22	22			22	22	22
	Std. Deviation					1.0	0.9			0.8	0.8	0.9

Continued on next page…

29-Jun-2004	Mean	23	23	21	21	22	22	23	22	22	22	22
	Std. Deviation	1.1	0.8	1.2	1.3	0.8	0.9	0.8	1.3	0.9	0.8	1.1
29-Jul-2004	Mean	22	22	22	21	21	21	22	22	20	10	21
	Std. Deviation	0.5	0.6	0.6	0.6	0.6	5.1	0.7	0.6	7.0	10.1	4.5
3-Aug-2004	Mean	21	21	21	21	21	22	21	21	22	21	21
	Std. Deviation	0.8	1.0	0.6	0.8	0.7	0.6	2.9	0.8	0.6	0.6	1.6
4-Aug-2004	Mean	28	28	28	28	29	28	28	28	28	21	28
	Std. Deviation	1.9	1.8	1.7	2.0	1.9	2.7	1.7	1.9	2.2	0.8	2.7
6-Aug-2004	Mean	23	23	23	23	23	23	22	23	23	23	23
	Std. Deviation	1.5	1.6	1.7	1.7	0.9	0.8	2.7	1.0	0.7	0.9	1.7
10-Aug-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	0.8	1.1	0.9	1.0	0.8	0.7	1.0	1.0	0.7	0.9	0.9
25-Aug-2004	Mean	23	23	23	23	24	24	23	23	24	23	23
	Std. Deviation	0.6	0.8	0.6	0.7	0.6	0.5	0.8	0.6	0.5	0.6	0.7
26-Aug-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	0.8	0.9	0.7	0.8	0.6	0.6	2.3	0.7	0.6	0.8	1.3
20-Sep-2004	Mean	23	22	23	22	23	23	22	23	23	23	23
	Std. Deviation	1.0	1.2	1.0	1.2	0.8	0.9	2.7	1.0	0.7	0.8	1.6
21-Sep-2004	Mean	23	22	23	22	23	23	22	23	22	23	22
	Std. Deviation	1.2	1.2	1.1	1.3	1.1	1.1	1.3	1.2	1.1	1.2	1.2
13-Oct-2004	Mean	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	1.3	1.4	1.3	1.4	1.2	1.3	1.4	1.5	1.4	1.5	1.4
15-Oct-2004	Mean	23	23	23	23	23	23	22	23	23	23	23
	Std. Deviation	1.3	1.5	1.4	1.4	1.3	1.3	3.8	1.4	1.2	1.3	2.2
20-Oct-2004	Mean	23	23	23	23	24	23	22	23	24	23	23
	Std. Deviation	1.4	1.4	1.1	1.4	1.2	1.2	3.2	1.3	1.2	1.3	2.1
25-Oct-2004	Mean	23	23	23	23	23	23	22	23	23	23	23
	Std. Deviation	1.5	1.6	1.3	1.5	1.2	1.2	3.3	1.4	1.1	1.2	2.1
2-Nov-2004	Mean	24	23	24	23	24	24	23	23	23	23	23
	Std. Deviation	0.9	1.0	1.1	1.1	1.0	0.9	3.0	1.0	1.0	1.2	1.8
3-Nov-2004	Mean	23	23	23	23	23	23	22	23	23	23	23
	Std. Deviation	1.2	1.1	1.1	1.2	1.1	1.2	3.1	1.2	1.2	1.3	1.9
9-Nov-2004	Mean	21	20	21	20	21	21	20	21	21	21	21
	Std. Deviation	1.8	1.8	1.9	2.0	2.0	2.0	3.0	1.9	2.0	1.9	2.3
10-Nov-2004	Mean	21	21	21	21	21	21	21	21	22	21	21
	Std. Deviation	2.0	2.1	2.2	1.8	2.2	2.1	3.3	2.1	2.1	2.2	2.5
16-Nov-2004	Mean	21	21	21	21	21	21	21	21	21	21	21
	Std. Deviation	0.4	0.3	0.4	0.4	0.4	0.4	2.4	0.4	0.4	0.4	1.4
17-Nov-2004	Mean	21	21	22	21	21	21	21	21	18	21	21
	Std. Deviation	0.3	0.3	0.3	0.3	0.3	0.3	3.0	0.3	6.6	0.3	2.2
Total (all dates)	Mean	23	22	23	22	22	23	22	22	22	22	22
	Std. Deviation	1.9	1.9	1.8	1.9	3.1	2.1	2.6	1.9	2.5	3.1	2.5

Table C-5. Fraction of Exhaust Sampled for PM Filter Gravimetric Mass Measurements (percent).

Date	diluter	EO Ave	EO Stdev	EI Ave	EI Stdev	FO Ave	FO Stdev	FI Ave	FI Stdev	AO Ave	AO Stdev	AI Ave	AI Stdev
16-Apr	B	0.064	0.945	0.079	0.657	0.131	0.253	0.088	0.047	0.081	0.095	0.041	0.016
21-Apr	B	0.046	0.055	0.055	0.122	0.143	0.601	0.088	0.052	0.063	0.048	0.065	0.179
23-Apr	B	0.051	0.047	0.036	0.175	0.151	0.191	0.096	0.077	0.068	0.681	0.065	0.045
28-Apr	B	0.027	0.077	0.039	0.066	0.095	0.113	0.189	0.237	0.161	1.694	0.071	0.063
30-Apr	B	0.027	0.030	0.030	0.034	0.110	0.103	0.081	0.036	0.108	0.099	0.072	0.064
27-May	B	0.033	0.055	0.026	0.038	0.401	1.010	0.111	0.075	0.095	0.076	0.121	0.272
29-Jun	B	0.061	0.060	0.041	0.092	0.111	0.095	0.299	1.715	0.199	1.056	0.199	0.622
29-Jul	B	0.064	0.085	0.033	0.036	0.087	0.047	0.104	0.136	0.060	0.063	0.067	0.098
3-Aug	B	0.074	0.106	0.074	0.106	0.083	0.056	0.109	0.108	0.082	0.543	0.073	0.329
4-Aug	B	0.027	0.022	0.048	0.064	0.078	0.055	0.070	0.064	0.041	1.959	0.076	0.064
6-Aug	B	0.032	0.027	0.061	0.081	0.042	3.154	0.110	0.084	0.224	0.078	0.103	0.116
10-Aug	B	0.033	0.030	0.039	0.045	0.124	0.886	0.106	0.087	0.098	0.154	0.052	2.095
25-Aug	B	0.040	0.054	0.049	0.158	0.095	0.062	0.150	0.357	0.091	0.106	0.050	2.115
26-Aug	B	0.039	0.042	0.035	0.021	0.104	0.264	0.104	0.264	0.107	0.166	0.095	0.116
20-Sep	B	0.049	0.105	0.046	0.508	0.112	0.106	0.120	0.166	0.097	0.159	0.109	0.689
21-Sep	B	0.025	0.044	0.027	0.034	0.098	0.079	0.272	0.798	0.113	0.463	0.103	0.174
13-Oct	B	0.040	0.046	0.046	0.058	0.178	0.560	0.078	0.028	0.122	0.062	0.910	0.310
15-Oct	B	0.032	0.027	0.036	0.039	0.088	0.048	0.095	0.068	0.086	0.114	0.065	0.053
20-Oct	B	0.036	0.039	0.068	0.219	0.087	0.060	0.224	0.448	0.084	0.150	0.156	0.885
25-Oct	B	0.028	0.023	0.053	0.077	0.084	0.064	0.117	0.131	0.069	0.108	0.115	0.724
2-Nov	B	0.081	0.104	0.046	0.092	0.094	0.040	0.182	0.308	0.057	0.037	0.060	0.034
3-Nov	B	0.056	0.078	0.026	0.023	0.069	0.033	0.107	0.156	0.068	0.064	0.083	0.151
9-Nov	B	0.064	0.072	0.056	0.221	0.447	0.728	0.271	0.433	0.199	0.741	0.070	0.054
10-Nov	B	0.051	0.259	0.059	0.248	0.186	0.545	0.175	0.147	NA	NA	0.242	0.803
16-Nov	B	0.073	0.120	0.041	0.074	0.105	0.063	0.117	0.738	0.067	0.045	0.097	0.093
17-Nov	B	0.060	0.174	0.093	0.215	0.086	0.039	0.096	0.041	0.061	0.036	0.126	0.164
min		0.025	0.022	0.026	0.021	0.042	0.033	0.070	0.028	0.041	0.036	0.041	0.016
max		0.081	0.945	0.093	0.657	0.447	3.154	0.299	1.715	0.224	1.959	0.910	2.115
mean		0.047	0.105	0.048	0.135	0.130	0.356	0.137	0.262	0.100	0.352	0.126	0.397
stdev		0.017	0.179	0.017	0.150	0.092	0.639	0.065	0.360	0.048	0.518	0.166	0.567

Table C-6. Panel Mode Calculation Example

The SMPS panel mode raw particle count data is not automatically corrected and converted to particle number concentration by the TSI AIM software. The following steps show how the conversion factor multiplier, $CF(D_p)$, was calculated for a single diameter, D_p. The conversion factor, $CF(D_p)$, when multiplied by the raw CPC counts gives dN/dlogDp in concentration units #/cm^3:

$$CF(D_p) * [raw\ CPC\ counts] \quad = \quad [\frac{dN}{d\log D_p}]\ \#cm^{-3} \qquad \text{(C.1)}$$

For this example, the SMPS aerosol flow rate was assumed to be 1.5 Lpm, the sheath flow rate was 15.0 Lpm and the diameter of interest was 10 nm (D_p=10 nm).

$$D_p = 10\ nm \qquad Q_a = 1.5\ L/\min \qquad Q_{sh} = 15.0\ L/\min$$

The following constant values were also assumed:

elementary charge: $q_e = 1.602177 \times 10^{-19}\ coulomb$

mean free path in air: $\lambda_{air} = 0.06610 \times 10^{-4}\ cm$ (1 atm, 20°C)

air viscosity: $\eta_{air} = 1.81 \times 10^{-4}\ dyne\,\sec\,cm^{-2}$ (1 atm, 20°C)

1. Calculate the transfer function relative half-width in mobility units by dividing the SMPS aerosol flow rate, Q_a, by the SMPS sheath flow rate, Q_{sh}:

$$\frac{Q_a}{Q_{sh}} = 0.10 \qquad \text{(C.2)}$$

2. Calculate the Cunningham slip correction factor for D_p, $C(\lambda_{air}, D_p)$ at the assumed temperature and pressure using the following equation (Friedlander, 2000):

$$C(\lambda_{air}, D_p) = 1 + \frac{\lambda_{air}}{D_p}[2.514 + 0.800 \exp(-0.55(\frac{D_p}{\lambda_{air}}))] \quad = \quad 22.45 \qquad \text{(C.3)}$$

3. From slip correction factor, q_e and viscosity of air, calculate electrical mobility of particles, Z_p of diameter D_p and *n* charges:

$$Z_p = [\frac{n}{3} q_e [\frac{C(\lambda_{air}, D_p)}{\pi\, \eta_{air}\, D_p}] \quad = \quad 0.02109\ cm^2 volt^{-1}\,\sec^{-1} \qquad \text{(C.4)}$$

4. Solve for the minimum and maximum diameters that exit the DMA (for a given DMA voltage setting) and are counted by the CPC by solving the following root equations for $D_{p[min]}$ and $D_{p[max]}$:

$$\frac{Z_p(D_p)}{Z_p(D_{p[\min]})} - (1 - \frac{Q_a)}{2Q_{sh}}] = 0 \qquad D_{p[\min]} = 9.743\,nm \qquad \text{(C.5)}$$

$$\frac{Z_p(D_p)}{Z_p(D_{p[\max]})} - (1 + \frac{Q_a)}{2Q_{sh}}] = 0 \qquad D_{p[\max]} = 10.25\,nm \qquad \text{(C.6)}$$

5. Note that the difference $D_{p[max]}$ - $D_{p[min]}$ is the bandwidth of the DMA size distribution that is transmitted to the CPC for counting for a given voltage setting on the DMA. This difference is equivalent to the transfer function width in diameter units.

$$\Delta D_p(Z_p) = D_{p[\max]} - D_{p[\min]} = 0.507\,nm \qquad \text{(C.7)}$$

6. Calculate the charging probability, $f(n, D_p)$, for particle of charge n and diameter D_p, using the Wiedensohler (1988) approximation of Fuchs (1963) diffusion charging model:

$$f(n, D_p) = 10^{\sum_{i=0}^{5} a_i(n) \log(\frac{D_p}{nm})^i} \qquad \text{(C.8)}$$

where the coefficients $a_i(n)$ were computed assuming that particles have a +1 charge only. Thus, the following column matrix $a_i(n=1)$, was used in equation (8) to compute the charging probability for a given D_p and the $f(+1,10\ nm)$ value calculated was 0.041115.

$$a_i(n=1) = \begin{Bmatrix} -2.3484 \\ 0.6044 \\ 0.4800 \\ 0.0013 \\ -0.1553 \\ 0.0320 \end{Bmatrix} \qquad f(+1,10nm) = 0.041115 \qquad \text{(C.9)}$$

7. Compute the correction factor, $CF(D_p)$, taking into account the fact that CPC counts half the particles:

$$CF(D_p) = [\frac{2}{f(1, D_p) * \log\frac{\Delta D_p(Z_p)}{D_p}}]\ \#cm^{-3} \qquad \text{(C.10)}$$

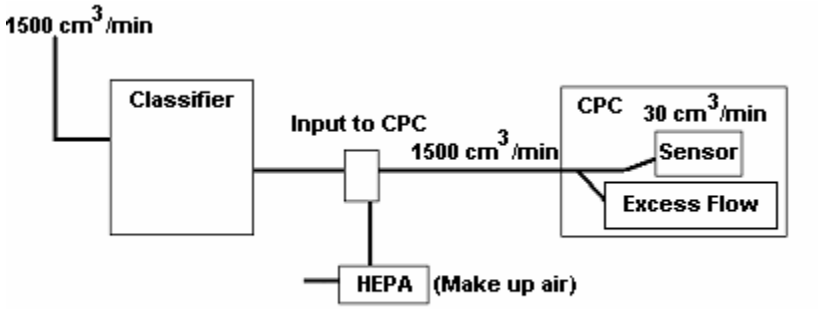
***CF* (10 nm) = 1.133 x 10^3 cm^{-3}**

This is the value that should be multiplied by raw Panel Mode counts collected using a DMA setting of 10 nm (using Q_a = 1.5 and Q_{sh} = 15.0) to obtain particle number concentration, dN/dlogDp, in #/cm^3.

The conversion factors for each panel mode diameter used in this study are summarized in Table 9 in the main body of the report.

8. The next step is to account for the DMA output flowrate, CPC inlet flowrate and CPC aerosol

flowrate. A schematic for basic SMPS flows is:



Schematic of flows in the SMPS during sampling. All flows were constant for each day of sampling.

The CPC sample flowrate is fixed at 30 cm^3/min, corresponding to 0.5 cm^3 of air per second that is sampled (TSI Inc, 2000). With this information, the raw data were computed to a **final dilution ratio-corrected particle concentration (#/cm^3)** with the following equation:

$$\frac{dN}{d\log Dp}\left[{}^{\#}/_{cm^3}\right] = (S_{10}) * \frac{Q_C}{Q_M} * \frac{1}{30 cm^3/\sec} * 60\sec/\min * CF(D_p) * DR \qquad \text{(C.11)}$$

Where, S_{10} is the one sec average data for ten 0.1-sec raw CPC counts. Q_c is the CPC inlet flowrate, Q_m is the monodisperse flowrate exiting the DMA, $CF(D_p)$ is the Correction Factor from Equation C.10, and DR is the minidiluter dilution ratio.

GLOSSARY OF TERMS FOR SMPS CONVERSION FORMULAS

Cunningham Slip Correction Factor, $C(\lambda_{air}, D_p)$. A correction factor to adjust for non-continuum effects on particle velocity that arise for very small particle diameters (diameters that approach the mean free path of air). The Cunningham slip correction factor is a function of the mean free path of the fluid (i.e., λ_{air}) and D_p.

$$C_c(\lambda_{air}, D_p) = 1 + \frac{\lambda_{air}}{D_p}\left[2.514 + 0.800\, e^{-0.55\left(\frac{D_p}{\lambda_{air}}\right)}\right].$$

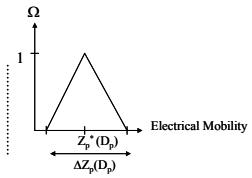
Electrical Mobility, Z_p. Motion of a charged particle in an electric field. Mobility is a function of the particle's charge, diameter, the air viscosity, and the Cunningham slip correction factor. The definition of electrical mobility arises from a force balance on a particle: Stokes' drag force = electrostatic force.

A particle with charge *n* in an electric field *E* will experience a force *F* proportional to the field strength ($F = n * E$). Stokes law describes the drag force on a particle moving in a fluid and applies to particles of diameter much larger than the mean free path of the fluid. The particle velocity in an electric field (v_e) is proportional to Z_p ($v_e = Z_p * E$). Electrical mobility (Z_p) is a function of the number of charges on a particle (n), the mobility diameter (D_p), the viscosity of the air (μ), the Cunningham slip correction factor (C_c), and the unit of elementary charge (q_e):

$$Z_p(D_p) = \left[\frac{q_e * n * C_c(\lambda, D_p)}{3 * \pi * \mu * D_p}\right].$$

Transfer Function, Ω. Probability that a particle of a given electrical mobility that enters the DMA will exit the slot on the DMA's center rod and be transferred to the CPC for counting. Because the opening in the DMA rod is of non-zero width and mobility is a non-unique function of particle diameter, there is a range of diameters (and electrical mobilities)

that pass through the slot for a given DMA voltage setting and flow rate. The range of particle electrical mobilities that, for a given DMA voltage, will reach the sampling slot is the "mobility bandwidth" of the DMA, $\Delta Z_p(D_p)$. This bandwidth is defined in mobility space by the lower and upper bounds of the transfer function $Z_p(D_{min})$ and $Z_p(D_{max})$, respectively, and is centered around $Z_p^*(D_p)$ as shown in the figure below. The triangular shaped transfer function has a maximum value of $\Omega = 1$ at $Z' = Q_{sh}$ for the symmetrical operating conditions used in the SMPS ($Q_a = Q_{CPC}$ and $Q_{sh} = Q_{excess}$) (Reischl, 1991).



Transfer function for DMA (Knutson and Whitby, 1975; Reischl, 1991)

Because mobility and particle diameter are linked *for a given particle charge*, the mobility bandwidth can be converted to a diameter bandwidth by computing the particle diameters corresponding to $Z_p(D_{min})$ and $Z_p(D_{max})$. This diameter bandwidth is defined by $\Delta D_p = D_{p[\max]} - D_{p[\min]}$ and these diameters are found by solving the following root equations:

$$\frac{Z_p(D_p)}{Z_p(D_{p[\max]})} - \left(1 + \frac{Q_a}{2 * Q_{sh}}\right) = 0; \qquad \frac{Z_p(D_p)}{Z_p(D_{p[\min]})} - \left(1 - \frac{Q_a}{2 * Q_{sh}}\right) = 0$$

Note that Z_p is a function of C_c and D_p and that C_c depends on D_p, thus, a simultaneous set of equations must be solved to determine ΔD_p. This solution may be found using software such as Mathcad or Excel's Solver Add-in.

REFERENCES CITED FOR SMPS CONVERSION EXAMPLE

Knutson, E.O. and Whitby, K.T., 1975. Aerosol classification by electric mobility: Apparatus, theory, and applications. J. Aerosol Sci., 6: 443-451.

Reischl, G.P., 1991. Measurement of ambient aerosols by the differential mobility analyzer method: Concepts and realization criterial for the size range between 2 and 500 nm. Aerosol Sci. Technol., 14: 5-24.

Table C-7. Filename Protocols for CTTRANSIT Study

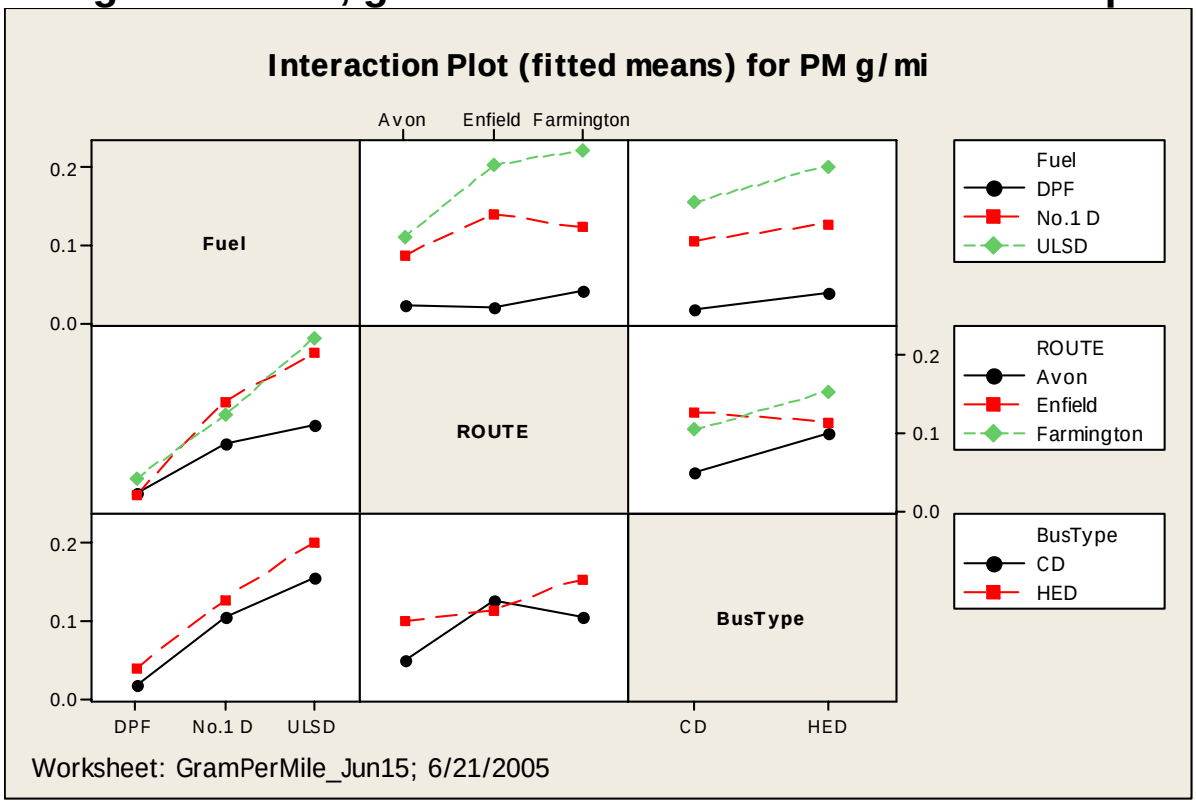
Filename Protocol	
Route	**Filename[1]**
HEPA and Tunnel Blank	ddmmm**X**00.ext
Warmup run	ddmmm**X**01.ext
Enfield Outbound and Inbound	ddmmm**X**02. ext
Farmington Outbound	ddmmm**X**03. ext
Avon Outbound	ddmmm**X**04. ext
Avon Inbound & Farmington Inbound	ddmmm**X**05. ext
HEPA2 and TB2	ddmmm**X**06. ext

[1]dd = day of month; mmm = month; **X** = instrument identifier (s=SMPS, e=ELPI, L=Labview, H=Horiba, P=Prolink, V=Vansco); 00 to 06 = route or QA/QC data file number; ext = instrument software-dependent filename extension.

Table C-8. PM Gravimetric Mass (micrograms) on Filters

DATE	BUS	REF	TB-1	Warm-Up	Enfield O	Enfield I	Farm O	Avon O	Avon I	Farm I	TB-2	TB-Avon
No.1 diesel												
23-Apr-04	201	3.7	5.3	90.3	45.0	38.3	50.0	26.7	26.3	35.7	7.3	
28-Apr-04	202	3.7	4.0	63.0	43.0	25.7	28.7	22.3	27.3	28.7	6.0	
26-May-04	202	0.3	0.7	46.3	35.7	45.3	32.0	22.7	26.0	35.3	3.7	
27-May-04	202	0.7	2.0	37.7	40.3	33.7	32.3	15.7	19.3	30.0	4.0	
29-Jun	202	0.7	broke	73.0	67.0	51.3	47.3	34.3	14.7	29.7	0.7	
16-Apr-04	H301	-1.0	1.3	84.0	51.3	48.0	29.7	18.0	28.0	27.0	-0.7	
21-Apr-04	H301	-1.7	5.7	65.7	44.3	46.7	43.7	25.0	27.3	51.0	4.0	
28-May	H301	1.0	0.7	138.3	115.3	78.7	42.3	nc	nc	nc		
2-Jun	H301	0.7	2.7	76.7	55.7	60.0	nc	nc	nc	nc	3.7	
30-Apr-04	H302	-0.7	1.3	53.7	42.3	50.0	40.0	34.7	31.7	30.3	1.0	
ULSD												
6-Aug-04	201	1.0	2.3	41.7	64.0	55.3	48.0	32.0	18.3	30.3	1.7	
10-Aug-04	201	0.3	2.0	80.7	60.3	50.3	64.3	18.7	25.0	49.0	2.7	
20-Sep-04	202	-1.0	2.7	65.0	64.3	60.0	45.7	22.7	27.3	34.7	5.3	
21-Sep-04	202	1.0	1.0	58.0	70.3	69.3	46.3	18.3	32.7	38.0	6.3	
29-Jul-04	H301	0.3	2.7	79.7	53.7	55.7	57.3	43.0	31.7	51.7	0.3	
3-Aug-04	H301	2.0	1.3	137.7	63.3	72.3	96.0	52.3	49.0	84.0	2.3	
4-Aug-04	H301	0.7	1.3	53.0	26.7	35.0	53.0	34.7	26.7	46.3	3.3	
25-Aug-04	H302	0.3	2.3	63.7	69.3	67.0	46.3	43.0	39.0	42.7	4.0	
26-Aug-04	H302	0.3	2.7	67.0	79.7	66.0	39.3	38.7	38.3	39.0	5.3	
USLD+DPF												
20-Oct-04	201	1.3	3.3	4.3	2.3	6.0	6.7	3.3	6.0	5.3	3.0	
25-Oct-04	201	0.3	3.3	12.3	1.3	8.7	7.3	6.3	2.0	6.0	1.7	
9-Nov-04	202	-0.3	2.7	12.0	6.3	12.3	17.3	8.7	5.0	15.7	6.3	4.0
10-Nov-04	202	1.0	4.0	12.7	4.0	9.3	12.7	5.7	5.0	12.3	5.0	3.0
12-Oct-04	H301	2.3	3.7	8.3	nc	nc	14.3	8.7	6.0	18.7	4.0	
13-Oct-04	H301	0.3	2.3	6.0	8.7	5.7	7.0	8.0	13.3	11.0	4.3	
15-Oct-04	H301	0.7	1.7	15.0	9.3	8.0	20.3	15.0	21.3	21.0	**	
16-Nov-04	H301	0.0	3.7	9.0	6.3	9.7	10.0	7.7	6.3	7.3	3.0	4.3
17-Nov-04	H301	-1.3	4.3	10.0	7.3	8.0	13.0	7.7	11.3	8.7	5.3	5.7
2-Nov-04	H302	0.7	2.7	15.0	4.7	2.0	16.0	5.7	7.0	9.3	4.0	5.3
3-Nov-04	H302	0.3	4.7	12.0	11.0	9.7	14.3	10.7	13.3	16.3	6.3	6.7

Table C-9. Mean g/mi PM filter emissions data interaction plot. Mean g/mi for each fuel/bus type/ route configuration are plotted by fuel-aftertreatment configuration (top row), driving route (middle) and bus type (bottom). Legends to the right apply to individual rows of the plot. The output was created using Minitab 14, generalized linear model ANOVA output.



The interaction plot data indicate possible interactions between Fuel and Route and between Route and BusType. These interaction terms were considered in the ANOVA model.

Table C-10. SMPS mean emissions (#/cm^3): ENFIELD.

Enfield Hybrid ULSD			
Ave	**Stdev**	**dp**	**n**
380570.7	405640.1	10	1689
842190.9	280725.2	20	773
2155215	618588.6	40	1168
1542813	472074.4	80	1107
1379870	309089.4	100	2441
778872.5	220532.1	130	1986

Enfield Diesel ULSD			
Ave	**Stdev**	**dp**	**n**
95155.39	131004	10	2564
645472	247437.1	20	901
2476241	716812.9	40	1618
2004452	545758.9	80	383
1327909	739266.7	100	799
797181.8	331425.2	130	1163

Enfield Hybrid No. 1			
Ave	**Stdev**	**dp**	**n**
687782.1	491173.7	10	1534
778664.6	121624.1	20	248
1544917	458520	40	512
1549161	566433.3	80	1499
552539.4	604003.6	100	511
531704	153949	130	1233

Enfield Diesel No. 1			
Ave	**Stdev**	**dp**	**n**
355534.6	359882	10	2061
761502.4	226612.3	20	520
1811457	563145.1	40	1109
1442975	609157.6	80	1241
1065472	399928.5	100	1099
435772.6	193275.2	130	1303

Enfield Hybrid DPF			
Ave	**Stdev**	**dp**	**n**
4162.147	13334.63	10	2175
1714.028	2499.756	20	2087
7142.993	4489.052	40	1590
8585.806	4918.298	80	1449
4288.9	3013.101	100	1754
1828.002	2399.885	130	1986

Enfield Diesel DPF			
Ave	**Stdev**	**dp**	**n**
4041.84	7033.572	10	1030
3078.635	3477.581	20	620
10378.79	6294.119	40	1182
3017.857	2561.706	80	135
3415.977	2547.98	100	1691
1373.242	1309.782	130	2216

Table C-11. SMPS mean emissions (#/cm^3): FARMINGTON.

Farm Hybrid ULSD			
Ave	**Stdev**	**dp**	**n**
1194148	709813.6	10	2255
274240.3	185653.1	20	1953
377931.2	360492.3	40	789
663873.2	705548.1	80	2174
687209.7	867754.8	100	2102
308123.8	305415.9	130	387

Farm Diesel ULSD			
Ave	**Stdev**	**dp**	**n**
405414.3	501844.1	10	2396
231215.3	164225.1	20	1650
486686.2	322941.7	40	1348
535951.7	325158.6	80	1595
418372.7	232287	100	490
249446	91743.21	130	1085

Farm Hybrid No. 1			
Ave	**Stdev**	**dp**	**n**
1497290	654295	10	1242
512088	672801.8	20	1471
216603.2	242628.5	40	200
307607.6	334916.4	80	261
262923.9	233658.7	100	678
149503.3	143188.9	130	601

Farm Diesel No. 1			
Ave	**Stdev**	**dp**	**n**
604286.2	475055.2	10	1428
248057.6	276240.6	20	2706
343516.5	258231.7	40	2308
387195	238916.9	80	2368
202137.9	150197	100	313
140878.9	116689.3	130	578

Farm Hybrid DPF			
Ave	**Stdev**	**dp**	**n**
321.9213	1461.154	10	2004
211.7563	789.9534	20	2374
818.1425	1534.237	40	1791
793.7264	1376.178	80	1544
785.2762	1296.13	100	3277
397.9762	762.709	130	1452

Farm Diesel DPF			
Ave	**Stdev**	**dp**	**n**
7145.993	13707.59	10	1121
341.8402	1002.006	20	826
1590.524	2271.136	40	1441
2110.377	2036.891	80	1086
1640.274	1593.403	100	2334
231.322	513.5102	130	429

Table C-12. SMPS mean emissions (#/cm^3): AVON Full Route.

Avon Hybrid ULSD			
Ave	**Stdev**	**dp**	**n**
2033887	2880732	10	1601
281695	259183	20	1637
657472	571375	40	2503
634989	592131	80	1140
591558	1664376	100	1767
415839	403471	130	3320

Avon Diesel ULSD			
Ave	**Stdev**	**dp**	**n**
1051695	1067875	10	2344
247886	187134	20	1655
412725	316308	40	2294
460848	340251	80	2153
427027	1486275	100	2335
282661	249956	130	2646

Avon Hybrid No. 1			
Ave	**Stdev**	**dp**	**n**
781313	479115	10	357
442609	568483	20	957
423019	396587	40	640
829250	609621	80	975
449245	333444	100	919
209792	182691	130	1746

Avon Diesel No. 1			
Ave	**Stdev**	**dp**	**n**
809520	874497	10	946
281724	328203	20	721
376510	446271	40	2622
386171	367963	80	1829
280424	240860	100	2960
118286	133108	130	3030

Avon Hybrid DPF			
Ave	**Stdev**	**dp**	**n**
9933	108327	10	3124
538	1377	20	2032
1256	2320	40	3696
2018	2917	80	2472
1393	1742	100	1588
747	1143	130	2868

Avon Diesel DPF			
Ave	**Stdev**	**dp**	**n**
10596	16621	10	1879
1167	2173	20	2273
3671	5548	40	1268
1968	2689	80	1445
1046	1388	100	926
561	1089	130	1634

Table C-13. SMPS mean emissions (#/cm^3): AVON Upgrade.

Hybrid AVON Upgrade ULSD			
Ave	**Stdev**	**dp**	**n**
4198709	3248067	10	348
675299.6	151440.5	20	175
1667781	404364.1	40	363
1368181	191276	80	120
966514.5	112155.5	100	121
501481.2	149424.7	130	404

Diesel AVON Upgrade ULSD			
Ave	**Stdev**	**dp**	**n**
2158205	957088.9	10	264
518793.1	93174.9	20	70
692732.3	315250.9	40	65
1010359	760150.3	80	44
789490.8	354469.5	100	300
578547.9	319379.5	130	449

Hybrid AVON Upgrade No. 1			
Ave	**Stdev**	**dp**	**n**
1001585	257846.8	10	136
1875812	220111.7	20	151
NA	NA	40	0
1279927	463102.4	80	434
NA	NA	100	0
451042	1426127	130	408

Diesel AVON Upgrade No. 1			
Ave	**Stdev**	**dp**	**n**
2184172	972255.1	10	459
3821316	1674060	20	40
923644.5	329379.6	40	149
630903.1	471902.5	80	448
605674.5	307039.6	100	254
325818.4	137506.1	130	214

Hybrid AVON Upgrade DPF			
Ave	**Stdev**	**dp**	**n**
2014.8	7009.33	10	267
1387.2	2067.18	20	495
5890.8	4340.16	40	107
5362.1	3079.3	80	214
2985.94	2005.7	100	318
1356.9	1317.9	130	269

Diesel AVON Upgrade DPF			
Ave	**Stdev**	**dp**	**n**
8413.205	12513.04	10	250
1301.579	2310.588	20	268
4917.942	5320.461	40	372
1101.68	1325.1	80	133
1114.586	1566.705	100	118
453.154	701.0037	130	60

Table C-14. SMPS mean emissions (#/cm^3): AVON Downgrade.

Hybrid AVON Downgrade ULSD			
Ave	**Stdev**	**dp**	**n**
759701.9	1261125	10	294
146470.4	163452.7	20	35
215252.9	327187	40	346
297498.3	314811.7	80	108
154526.5	214551.7	100	140
204620.4	251825.2	130	571

Diesel AVON Downgrade ULSD			
Ave	**Stdev**	**dp**	**n**
213048.9	420924.4	10	121
83483.66	118033	20	168
62846.87	109997.4	40	119
63598.02	132747.4	80	147
77158.78	148400.1	100	261
31054.83	49741.29	130	317

Hybrid AVON Downgrade No. 1			
Ave	**Stdev**	**dp**	**n**
NA	NA	10	0
106329.4	183017.3	20	335
305735.9	206258.8	40	19
141631.4	151797.3	80	208
NA	NA	100	0
130719	155301.7	130	240

Diesel AVON Downgrade No. 1			
Ave	**Stdev**	**dp**	**n**
437684	751121.3	10	224
155729.8	289422.7	20	127
199386.7	261670.9	40	331
57337.88	101926	80	411
18078.45	37710.75	100	116
22135.11	36707.91	130	302

Hybrid AVON Downgrade DPF			
Ave	**Stdev**	**dp**	**n**
1133	826.02	10	481
284.92	898.41	20	170
689.97	1361.1	40	288
382.65	718.83	80	245
641.7	1112.4	100	236
318.05	725.43	130	200

Diesel AVON Downgrade DPF			
Ave	**Stdev**	**dp**	**n**
972.142	3487.955	10	324
647.4497	1717.904	20	157
2852.702	7389.197	40	188
525.2093	983.6967	80	107
NA	NA	100	0
790.5911	1213.907	130	185

Table C-15. ELPI TPN (#/cm^3) Statistics by Bus-Route-Fuel.

Bus ID	Route	Fuel/Aftertmt	Mean	Std. Dev.	Minimum	Maximum	n
201	Avon	DPF	727	2606	13.5	63128	2577
202	Avon	DPF	3222	1712	3.1	12741	2669
H301	Avon	DPF	10850	54956	8.4	694670	5458
H302	Avon	DPF	1824	5010	5.3	39699	2617
201	Enfield	DPF	1944	2707	66.7	46852	2553
202	Enfield	DPF	2133	1146	75.1	9513	2541
H301	Enfield	DPF	5253	13477	100.8	143950	5272
H302	Enfield	DPF	2380	2303	61.9	33185	2890
201	Farmington	DPF	509	2633	29.7	62200	3782
202	Farmington	DPF	3669	1420	20.3	11700	3768
H301	Farmington	DPF	405	2330	3.1	94800	7463
H302	Farmington	DPF	277	276	5.1	2600	3829
201	Avon	No.1D	514598	447306	67.5	3125300	4392
202	Avon	No.1D	387110	305455	24.6	1611500	9279
H301	Avon	No.1D	555282	505737	19.9	3090800	4393
H302	Avon	No.1D	440199	351477	586	2763400	2747
201	Enfield	No.1D	581188	274607	436	3294900	4301
202	Enfield	No.1D	532174	262679	243.3	1643700	9517
H301	Enfield	No.1D	826122	631873	63.6	7402700	7172
H302	Enfield	No.1D	1093034	637327	12934	3792100	2729
201	Farmington	No.1D	381406	328105	1314.6	7262000	5976
202	Farmington	No.1D	307264	203581	472.2	1331900	13240
H301	Farmington	No.1D	534728	477127	196.9	6679900	7434
H302	Farmington	No.1D	424743	314204	407.6	3100800	4357
201	Avon	ULSD	244754	164548	104	862000	2698
202	Avon	ULSD	333029	232395	112	3150000	4237
H301	Avon	ULSD	362421	278643	1650	2050000	2785
H302	Avon	ULSD	328880	263457	367	1470000	2770
201	Enfield	ULSD	479066	242402	456.8	1337200	2899
202	Enfield	ULSD	749400	412362	637	6822800	3933
H301	Enfield	ULSD	511874	233569	11200	2290000	2814
H302	Enfield	ULSD	666251	307407	3330	1360000	2680
201	Farmington	ULSD	231365	151390	162	843000	4173
202	Farmington	ULSD	309823	210113	122	2710000	5466
H301	Farmington	ULSD	383948	334654	1810	2150000	3729
H302	Farmington	ULSD	307800	260394	339	1560000	3696

Table C-16. ELPI TPN (#/cm^3) Statistics by Bus Type-Route-Fuel.

Bus TYPE	Route	Fuel/ Aftertmt	Mean	Std. Dev.	Minimum	Maximum	n
CD	Avon	DPF	1996	2526	3.12	63128	5246
HED	Avon	DPF	7925	45467	5.3	694670	8075
CD	Enfield	DPF	2038	2083	66.68	46852	5094
HED	Enfield	DPF	4236	11004	61.87	143950	8162
CD	Farmington	DPF	2086	2641	20.3	62200	7550
HED	Farmington	DPF	362	1902	3.12	94800	11292
CD	Avon	No.1D	428067	362132	24.64	3125300	13671
HED	Avon	No.1D	511005	456077	19.94	3090800	7140
CD	Enfield	No.1D	547430	267403	243.31	3294900	13818
HED	Enfield	No.1D	899690	644481	63.59	7402700	9901
CD	Farmington	No.1D	330322	251413	472.16	7262000	19216
HED	Farmington	No.1D	494086	427570	196.86	6679900	11791
CD	Avon	ULSD	298686	213019	104	3150000	6935
HED	Avon	ULSD	345696	271671	367	2050000	5555
CD	Enfield	ULSD	634690	375048	456.75	6822800	6832
HED	Enfield	ULSD	587180	282810	3330	2290000	5494
CD	Farmington	ULSD	275856	190958	122	2710000	9639
HED	Farmington	ULSD	346043	302382	339	2150000	7425

Table C-17. ELPI – SMPS Corresponding Stage-Diameter Table.

SMPS Mobility Diameter (nm)	Corresponding ELPI Stage
10	S.1 (7 - 28.8 nm)
20	S.1 (7 - 28.8 nm)
40	S.2 (28.8 - 56.4 nm)
80	S.3 (56.4 - 95.1 nm)
100	S.4 (95.1 - 159 nm)
130	S.4 (95.1 - 159 nm)

Figure C-1. ELPI (Stage 1) – SMPS (10 nm) Correspondence Plot.

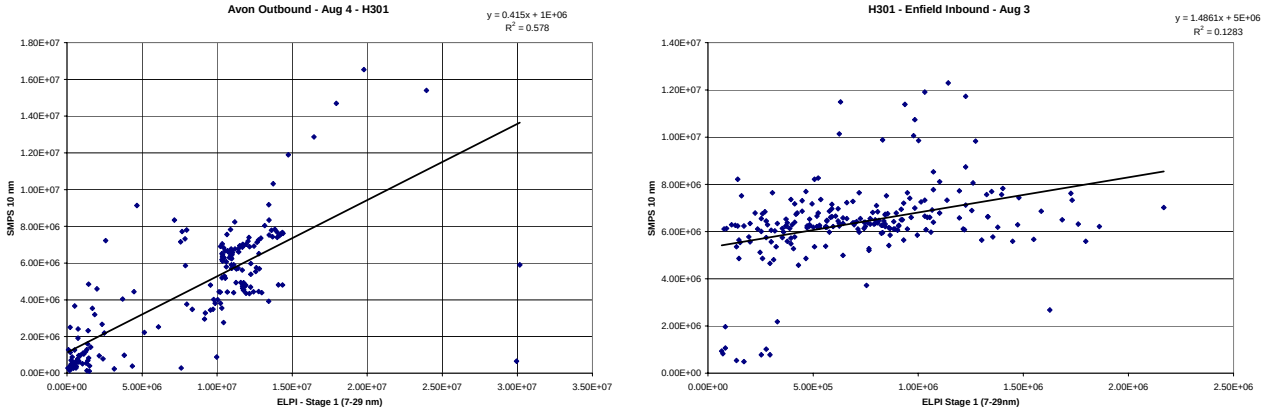


Figure C-2. ELPI (Stage 2) – SMPS (40 nm) Correspondence Plot.

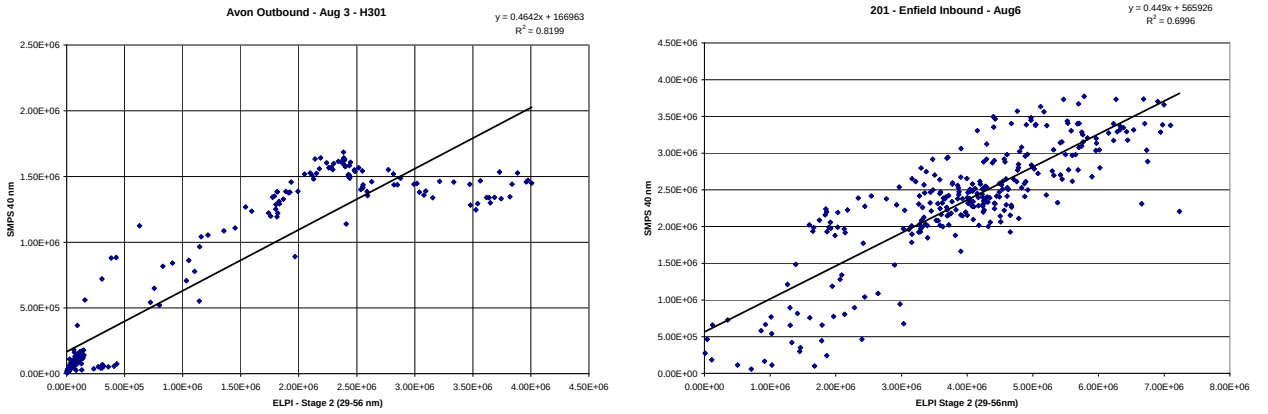


Figure C-3. ELPI (Stage 3)– SMPS (80, 100 or 130 nm) Correspondence Plot.

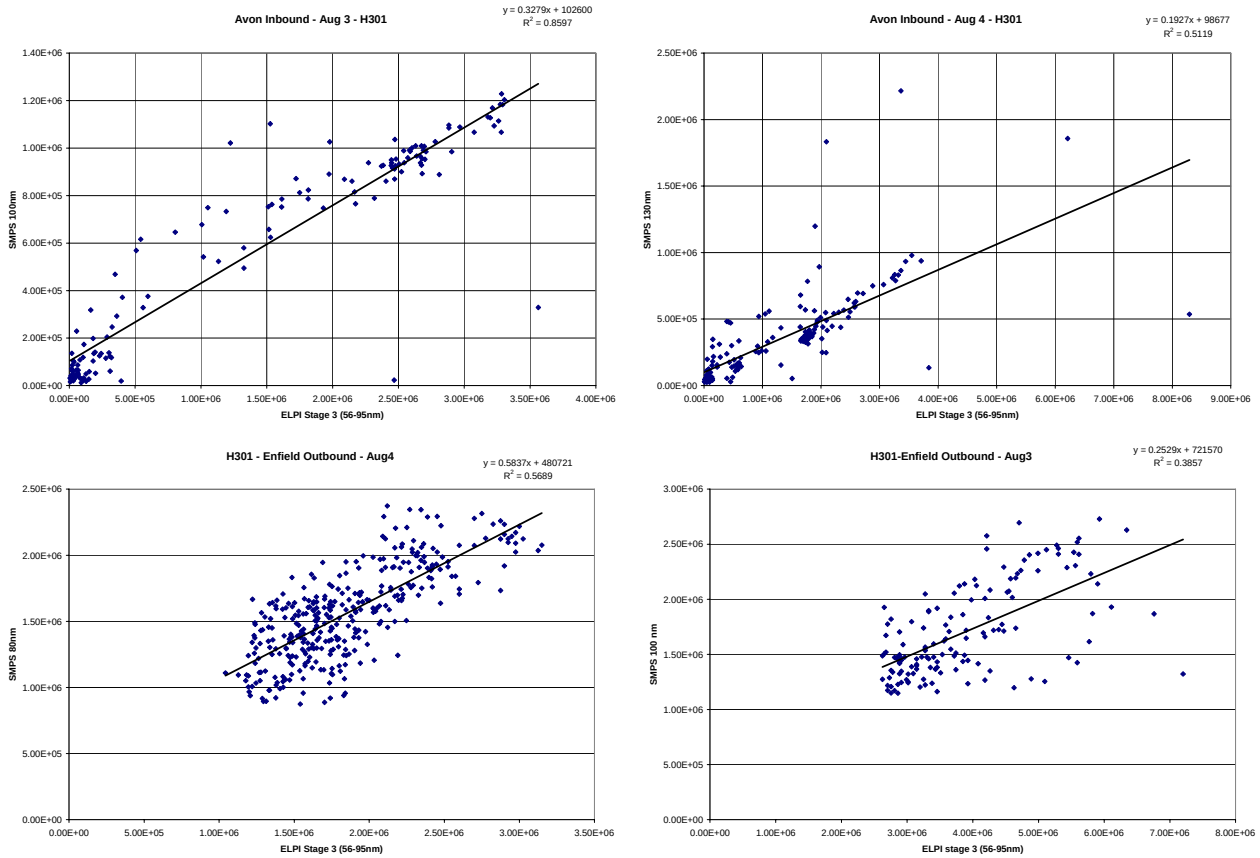


Figure C-4. ELPI (Stage 4)– SMPS (130 nm) Correspondence Plot.

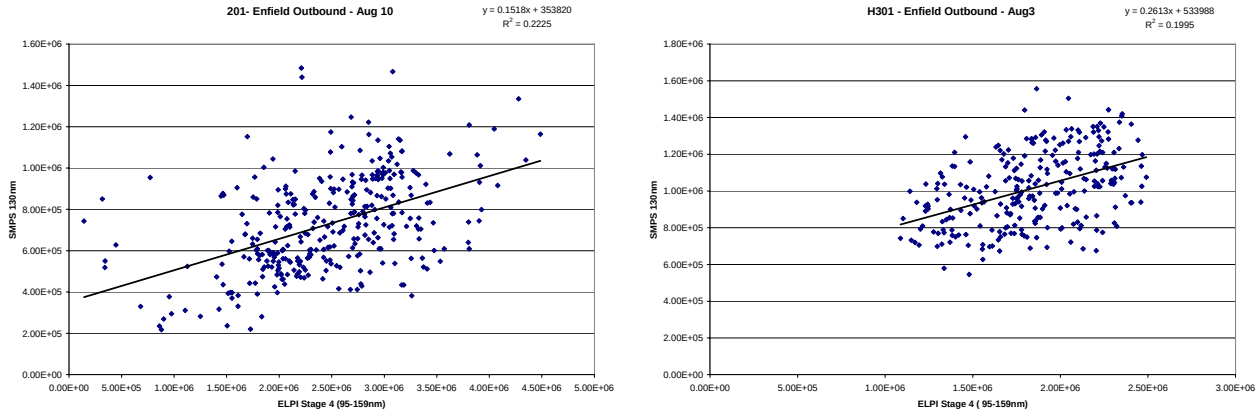


Figure C-5. ELPI (TPN) – SMPS Scatter Plot and Time Series.

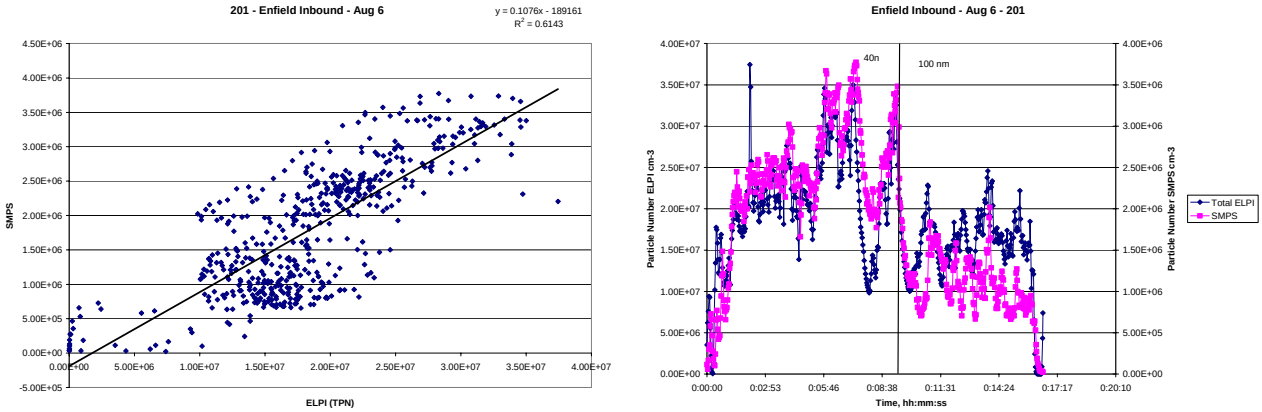


Figure C-6. Relationships between fuel sulfur content and g/mi PM emission rate.