ADDITIONAL MATERIALS AVAILABLE ON THE HEI WEB SITE

Research Report 184

Advanced Collaborative Emissions Study (ACES): Lifetime Cancer and Non-Cancer Assessment in Rats Exposed to New-Technology Diesel Exhaust

Part 1. Assessment of Carcinogenicity and Biologic Responses in Rats after Lifetime Inhalation of New-Technology Diesel Exhaust in the ACES Bioassay

Appendix I.
Characterization of Exposure Atmospheres in the ACES Bioassay

McDonald et al.

Additional Materials I.C. Exposure Summary for Routine Monitoring of Exposure Atmospheres

Additional Materials may appear in a different order from that in the original Investigators' Report, and some remnants of their original names may be apparent.

Additional Materials I.C was originally Appendix I.

The HEI Exposure Characterization Panel reviewed the draft of this appendix but not the final version. This appendix did not undergo the HEI scientific editing and production process but was proofread for spelling and grammar only.

Correspondence may be addressed to Dr. Jacob D. McDonald, Lovelace Respiratory Research Institute, 2425 Ridgecrest Dr., SE, Albuquerque, NM 87108; e-mail: *JMcDonal@lrri.org*.

Although this document was produced with partial funding by the United States Department of Energy (DOE), under the terms of Contract/Award Number DE-AC26-05NT42429, and certain motor vehicle and engine manufacturers, the opinion expressed herein are those of the authors and do not necessarily reflect the views of the DOE or motor vehicle and engine manufacturers.

Appendix I.

Exposure Summary for Routine Monitoring of Exposure Atmospheres

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total)

	Tunnel	High-Level Chamber								Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	CO_2 (ppm)	CO (ppm)	HC (ppm)	SO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
May-10	28.97	4.76	8.32	3.56	4710	7.5	0.2	23	21.4	0.7	13	43
	29.90	5.21	10.19	4.98	4902	6.8	≤ LOD	24	*	*	*	45
Jun-10	27.96	4.80	8.88	4.08	4670	8.1	0.3	17	*	*	*	15
	28.50	4.07	7.06	2.99	4563	7.6	0.2	18	8.3	0.7	11	38
	28.76	4.73	7.12	3.14	4563	7.4	0.2	18	3.5	0.5	*	32
Jul-10	26.73	5.83	10.18	4.36	4859	10.4	0.6	22	32.1	1.5	*	31
	26.42	4.08	6.57	2.49	4948	10.1	0.5	22	*	*	11	32
	26.40	4.72	7.81	3.08	4962	10.5	0.6	21	8.2	0.8	*	19
Aug-10	22.57	5.27	9.24	3.97	5768	13.7	0.1	22	59.5	1.6	16	42
	22.53	5.61	9.81	4.20	5888	13.4	0.2	22	*	*	19	28
	22.47	6.43	10.41	3.98	5526	12.9	0.2	22	*	*	*	*
Sep-10	22.82	4.33	8.28	3.95	5862	8.4	*	18	35.4	0.9	*	*
	22.76	4.74	9.19	4.45	5717	8.6	*	18	9.0	0.5	8	20
	22.77	5.33	9.99	4.66	5749	8.6	*	18	*	*	*	*
Oct-10	21.04	4.65	8.77	4.12	5928	9.7	*	19	*	*	*	*
	26.53	5.30	10.12	4.82	5087	3.7	0.6	24	4.1	0.1	6	25
	21.19	4.79	9.02	4.24	5955	9.8	*	19	*	*	*	*
Nov-10	25.75	5.78	10.35	4.58	5071	3.8	0.6	22	*	*	*	*
	26.53	5.30	10.12	4.82	5087	3.7	0.6	24	4.1	0.1	6	25
	25.67	5.03	9.50	4.48	5092	3.8	0.6	23	*	*	*	*
Dec-10	28.41	6.26	10.31	4.06	4668	4.1	-0.1	22	*	*	*	*
	28.39	4.81	8.63	3.82	4760	4.1	≤ LOD	22	3.3	0.1	5	12
	29.09	5.41	9.82	4.41	4800	4.0	-0.1	22	*	*	*	*
Jan-11	29.67	7.02	11.32	4.30	4702	4.2	1.1	26	*	*	*	*
	29.95	5.65	10.01	4.36	4702	4.3	1.3	26	2.2	0.1	4	18
	29.84	5.82	9.79	3.97	4695	4.2	1.1	26	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	High-Level Chamber								Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	CO_2 (ppm)	CO (ppm)	HC (ppm)	SO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Feb-11	38.22	6.90	11.25	4.35	5534	5.1	0.9	32	*	*	*	*
	38.05	6.97	11.94	4.97	5502	5.1	0.9	32	3.3	0.1	5	21
	37.85	5.99	10.18	4.18	5504	5.1	0.9	33	*	*	*	*
Mar-11	41.20	7.00	11.13	4.14	5165	5.1	0.4	29	*	*	*	*
	40.83	6.26	10.60	4.34	5180	5.1	0.4	30	1.7	≤ LOD	5	16
	41.14	6.64	11.02	4.38	5198	5.0	0.4	30	*	*	*	*
Apr-11	41.80	8.10	12.69	4.60	5346	5.7	1.2	32	*	*	*	*
	41.75	6.82	11.25	4.44	5308	5.9	1.2	34	2.0	0.1	4	35
	42.04	6.78	10.91	4.13	5355	5.8	1.0	34	*	*	*	*
May-11	40.38	8.31	12.66	4.35	5260	7.1	1.1	28	*	*	*	*
	39.76	7.03	11.44	4.42	5234	7.1	1.1	28	3.7	0.1	8	20
	40.30	7.01	11.16	4.16	5309	7.1	1.0	28	*	*	*	*
Jun-11	28.29	8.16	12.22	4.06	5228	7.3	1.1	33	*	*	*	*
	28.24	7.65	11.97	4.32	5219	7.7	1.1	34	5.7	0.2	7	21
	28.48	7.57	11.77	4.20	5262	7.4	1.2	33	*	*	*	*
Jul-11	24.05	9.80	13.69	3.89	5969	10.9	1.4	31	*	*	*	*
	24.08	8.17	12.16	4.00	5945	11.0	1.4	31	15.6	0.7	12	22
	24.13	8.86	13.14	4.28	5929	11.8	1.1	30	*	*	*	*
Aug-11	28.52	8.82	12.86	4.04	5797	7.3	1.5	34	*	*	*	*
	28.88	8.92	13.49	4.58	5792	7.1	1.5	34	36.3	0.5	15	23
	29.10	7.64	11.68	4.04	5805	7.3	1.5	34	*	*	*	*
Sep-11	29.56	9.01	13.36	4.36	5416	5.2	0.6	31	*	*	*	*
	30.13	7.75	12.16	4.42	5495	5.5	0.6	32	35.8	0.4	16	49
	29.94	7.83	12.21	4.39	5452	5.2	0.6	32	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	High-Level Chamber									Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	CO_2 (ppm)	CO (ppm)	HC (ppm)	SO_2 (ppb)	DMM (PM) (µg/m^3)	PASS (EC) (µg/m^3)	Inlet (µg/m^3)	Chamber (µg/m^3)
Oct-11	31.09	8.06	12.00	3.95	5110	2.3	0.3	33	*	*	*	*
	31.52	7.04	11.30	4.26	5008	2.5	0.3	32	20.3	0.4	22	39
	31.72	7.27	11.53	4.26	5077	2.5	0.3	33	*	*	*	*
Nov-11	34.24	8.97	13.02	4.05	5189	2.0	≤ LOD	39	*	*	*	*
	34.24	7.66	11.72	4.05	5154	2.1	-0.4	38	5.8	0.2	9	32
	33.97	7.60	11.61	4.01	5171	2.1	-0.2	38	*	*	*	*
Dec-11	31.68	2.91	4.32	4.06	5484	3.4	0.1	38	*	*	*	*
	31.83	8.59	12.72	4.13	5406	3.2	≤ LOD	39	6.5	0.2	15	27
	30.76	8.81	12.61	3.80	5418	2.9	≤ LOD	40	*	*	*	*
Jan-12	32.68	9.04	13.44	4.41	4712	3.0	≤ LOD	39	*	*	*	*
	32.35	8.44	12.59	4.15	4722	2.9	0.1	40	4.7	0.1	10	29
	32.53	9.16	13.39	4.24	4734	3.0	≤ LOD	40	*	*	*	*
Feb-12	33.93	9.99	14.32	4.33	5540	3.6	0.3	47	*	*	*	*
	34.00	9.99	14.42	4.43	5373	3.6	0.3	46	6.5	0.1	11	46
	33.52	11.01	15.34	4.33	5492	3.5	0.4	47	*	*	*	*
Mar-12	35.20	10.19	14.54	4.36	5065	3.9	≤ LOD	47	*	*	*	*
	35.19	9.74	14.11	4.38	5097	3.9	≤ LOD	47	4.0	0.1	16	25
	35.13	10.24	14.58	4.35	5015	3.9	≤ LOD	47	*	*	*	*
Apr-12	33.33	8.84	12.88	4.04	4706	4.0	≤ LOD	39	*	*	*	*
	33.23	8.68	12.77	4.33	4720	4.0	≤ LOD	36	3.8	0.1	11	26
	33.02	9.63	13.81	4.18	4737	3.8	≤ LOD	36	*	*	*	*
May-12	31.33	9.32	13.29	3.97	4577	4.2	0.1	7	*	*	*	*
	31.38	9.11	13.39	4.29	4510	4.0	≤ LOD	7	5.9	0.1	13	19
	31.14	10.11	14.51	4.41	4668	4.0	≤ LOD	7	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	High-Level Chamber									Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	CO_2 (ppm)	CO (ppm)	HC (ppm)	SO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Jun-12	29.17	9.14	13.42	4.28	5208	9.0	*	38	*	*	*	*
	29.09	8.88	13.29	4.42	5123	9.0	*	38	5.0	0.1	11	21
	28.91	9.12	13.52	4.40	5162	9.1	*	41	*	*	*	*
Jul-12	24.04	8.83	12.85	4.02	5241	8.3	*	32	*	*	*	*
	24.11	8.73	13.13	4.40	5310	8.3	*	32	34.0	0.2	15	24
	24.24	8.78	12.94	4.17	5356	8.1	*	32	*	*	*	*
Aug-12	27.95	10.48	14.87	4.39	5038	6.3	0.2	35	*	*	*	*
	28.21	9.20	13.62	4.42	5083	6.8	0.2	35	9.4	0.2	13	26
	28.07	9.99	14.69	4.71	5009	6.4	0.2	34	*	*	*	*
Sep-12	30.15	*	*	*	5162	6.4	0.2	38	*	*	*	*
	30.85	8.24	12.58	4.35	4263	4.7	0.3	36	10.5	0.2	16	24
	30.67	8.94	13.45	4.51	4271	4.6	0.3	36	*	*	*	*
Oct-12	30.10	8.53	13.08	4.56	4244	4.6	0.2	39	7.6	0.2	34	42
	30.11	9.45	14.13	4.68	4214	4.7	0.2	40	*	*	*	*
Nov-12	26.35	8.62	12.90	4.29	4009	4.6	0.1	39	6.5	0.2	23	104
	26.57	9.75	14.23	4.49	3960	5.1	0.1	38	*	*	*	*
Dec-12	24.96	9.17	13.91	4.75	4321	5.6	0.1	46	4.1	0.2	6	44
	25.14	9.81	14.12	4.31	4370	5.5	0.1	50	*	*	*	*
average	30.28	7.54	11.72	4.23	5114	6.0	0.45	31	12.3	0.4	12	31
stdev	5.17	1.88	2.14	0.38	468	2.7	0.48	9	13.6	0.4	6	16
%cv	17.1%	25.0%	18.3%	9.0%	9.2%	45.2%	104.6%	29.8%	110.8%	108.9%	53.1%	51.0%
min	21.04	2.91	4.32	2.49	3960	2.0	-0.38	7	1.7	≤ LOD	4	12
max	42.04	11.01	15.34	4.98	5969	13.7	1.48	50	59.5	1.6	34	104
%target				**101%**								

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total)

	Tunnel	Mid-Level Chamber					Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
May-10	28.97	0.96	1.82	0.86	*	*	4	55
	29.90	1.41	2.57	1.17	*	*	*	47
Jun-10	27.96	1.00	1.89	0.89	*	*	*	20
	28.50	1.14	2.14	0.99	*	*	3	34
	28.76	1.57	2.53	1.05	*	*	*	24
Jul-10	26.73	1.43	2.51	1.08	*	*	*	27
	26.42	1.08	1.80	0.72	*	*	3	37
	26.40	1.48	2.26	0.77	*	*	*	26
Aug-10	22.57	2.13	3.37	1.24	*	*	*	*
	22.53	1.44	2.39	0.95	*	*	10	11
	22.47	1.75	2.62	0.86	*	*	*	*
Sep-10	22.82	1.32	2.24	0.91	*	*	*	*
	22.76	1.17	2.17	1.00	1.6	*	3	16
	22.77	1.18	2.10	0.92	*	*	*	*
Oct-10	21.04	1.13	1.95	0.83	*	*	*	*
	26.53	1.21	2.18	0.98	*	*	5	75
	21.19	1.22	2.06	0.84	*	*	*	*
Nov-10	25.75	1.34	2.25	0.91	*	*	*	*
	26.53	1.21	2.18	0.98	*	*	5	75
	25.67	1.32	2.16	0.84	*	*	*	*
Dec-10	28.41	1.38	2.21	0.83	*	*	*	*
	28.39	1.25	2.16	0.91	*	*	5	18
	29.09	1.25	2.08	0.84	*	*	*	*
Jan-11	29.67	1.43	2.28	0.85	*	*	*	*
	29.95	1.29	2.13	0.84	*	*	2	17
	29.84	1.59	2.53	0.93	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	Mid-Level Chamber					Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Feb-11	38.22	1.44	2.27	0.83	*	*	*	*
	38.05	1.46	2.40	0.95	*	*	2	26
	37.85	1.84	2.85	1.01	*	*	*	*
Mar-11	41.20	1.48	2.31	0.83	*	*	*	*
	40.83	1.46	2.29	0.83	*	*	2	22
	41.14	1.44	2.27	0.83	*	*	*	*
Apr-11	41.80	1.67	2.62	0.95	*	*	*	*
	41.75	1.57	2.42	0.85	0.5	≤ LOD	1	11
	42.04	1.57	2.42	0.85	*	*	*	*
May-11	40.38	1.57	2.40	0.83	*	*	*	*
	39.76	1.50	2.32	0.83	*	*	2	26
	40.30	1.61	2.42	0.81	*	*	*	*
Jun-11	28.29	1.61	2.42	0.81	*	*	*	*
	28.24	1.61	2.43	0.83	*	*	2	19
	28.48	1.85	2.74	0.88	*	*	*	*
Jul-11	24.05	1.93	2.74	0.82	*	*	*	*
	24.08	1.79	2.57	0.80	*	*	3	19
	24.13	2.18	3.00	0.84	*	*	*	*
Aug-11	28.52	2.14	3.07	0.94	*	*	*	*
	28.88	1.82	2.60	0.78	*	*	2	10
	29.10	2.23	3.03	0.80	*	*	*	*
Sep-11	29.56	1.71	2.55	0.84	*	*	*	*
	30.13	1.78	2.62	0.84	*	*	6	13
	29.94	2.09	2.95	0.85	*	*	*	*
Oct-11	31.09	1.63	2.45	0.82	*	*	*	*
	31.52	1.61	2.50	0.89	*	*	4	28
	31.72	1.68	2.50	0.82	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	Mid-Level Chamber					Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Nov-11	34.24	1.57	2.40	0.83	*	*	*	*
	34.24	1.50	2.32	0.82	*	*	2	16
	33.97	1.72	2.50	0.78	*	*	*	*
Dec-11	31.68	1.36	2.14	0.78	*	*	*	*
	31.83	1.61	2.43	0.82	*	*	10	98
	30.76	1.76	2.52	0.76	*	*	*	*
Jan-12	32.68	1.47	2.29	0.82	*	*	*	*
	32.35	1.65	2.47	0.82	*	*	2	20
	32.53	1.72	2.56	0.83	*	*	*	*
Feb-12	33.93	1.59	2.40	0.81	*	*	*	*
	34.00	1.67	2.48	0.81	*	*	6	25
	33.52	2.01	2.83	0.82	*	*	*	*
Mar-12	35.20	1.60	2.47	0.86	*	*	*	*
	35.19	1.75	2.55	0.81	*	*	6	36
	35.13	1.79	2.60	0.82	*	*	*	*
Apr-12	33.33	1.46	2.30	0.83	*	*	*	*
	33.23	1.58	2.40	0.82	*	*	4	26
	33.02	1.63	2.42	0.79	*	*	*	*
May-12	31.33	1.48	2.27	0.79	*	*	*	*
	31.38	1.72	2.54	0.83	*	*	7	41
	31.14	1.82	2.64	0.82	*	*	*	*
Jun-12	29.17	1.50	2.32	0.82	*	*	*	*
	29.09	1.69	2.55	0.86	*	*	3	21
	28.91	1.80	2.61	0.81	*	*	*	*
Jul-12	24.04	1.87	2.74	0.87	*	*	*	*
	24.11	2.00	2.85	0.85	*	*	4	24
	24.24	2.11	2.88	0.78	*	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

	Tunnel	Mid-Level Chamber					Filter (PM)	
Date	NO_x (ppm)	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Aug-12	27.95	2.27	3.07	0.80	*	*	*	*
	28.21	2.29	3.16	0.86	*	*	4	23
	28.07	3.47	4.38	0.91	*	*	*	*
Sep-12	30.15	2.75	4.06	1.31	*	*	*	*
	30.85	2.80	3.81	1.01	*	*	6	24
	30.67	2.77	3.64	0.88	*	*	*	*
Oct-12	30.10	1.78	2.67	0.89	*	*	13	32
	30.11	1.88	2.85	0.97	*	*	*	*
Nov-12	26.35	1.83	2.79	0.96	*	*	12	38
	26.57	1.92	2.88	0.96	*	*	*	*
Dec-12	24.96	1.57	2.44	0.87	*	*	23	50
	25.14	2.64	3.82	1.19	*	*	*	*
average	30.28	1.68	2.55	0.88	1.1	≤ LOD	5	30
stdev	5.17	0.41	0.45	0.10	0.7	*	4	19
%cv	17.1%	24.6%	17.5%	11.6%	69.1%	*	86.5%	63.0%
min	21.04	0.96	1.80	0.72	0.5	≤ LOD	1	10
max	42.04	3.47	4.38	1.31	1.6	≤ LOD	23	98
%target				**110%**				

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total)

Date	Tunnel	Low-Level Chamber					Filter		Control Chamber					Filter (PM)
	NO_x (ppb)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM ($\mu g/m^3$)	PASS ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
May-10	28.97	121	237	117	*	*	1	59	2	5	4	*	*	39
	29.90	284	414	131	*	*	*	*	1	-1	-2	*	*	77
Jun-10	27.96	79	180	101	*	*	*	12	1	2	1	*	*	10
	28.50	113	224	111	*	*	3	38	2	9	7	*	*	74
	28.76	134	252	118	*	*	*	29	2	9	7	*	*	30
Jul-10	26.73	142	283	141	*	*	*	14	1	-1	-2	*	*	21
	26.42	159	266	107	*	*	1	21	1	-2	-3	*	*	28
	26.40	205	336	131	*	*	*	18	1	1	≤ LOD	*	*	23
Aug-10	22.57	130	206	76	*	*	*	*	15	55	39	*	*	*
	22.53	206	323	117	*	*	2	12	20	47	27	*	*	25
	22.47	140	240	99	*	*	*	*	18	46	28	*	*	*
Sep-10	22.82	219	347	126	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	22.76	189	307	117	*	*	2	12	≤ LOD	≤ LOD	≤ LOD	*	*	22
	22.77	152	259	106	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Oct-10	21.04	212	306	94	*	*	*	*	1	-2	-4	*	*	*
	26.53	220	334	114	*	*	1	17	2	-13	-15	*	*	19
	21.19	167	267	103	*	*	*	*	1	-3	-4	*	*	*
Nov-10	25.75	225	327	102	*	*	*	*	2	-14	-16	*	*	*
	26.53	220	334	114	*	*	1	17	2	-13	-15	*	*	19
	25.67	233	362	129	*	*	*	*	2	-14	-16	*	*	*
Dec-10	28.41	429	532	103	*	*	*	*	≤ LOD	-1	-1	*	*	*
	28.39	325	420	95	*	*	2	10	≤ LOD	-1	-1	*	*	14
	29.09	343	463	119	*	*	*	*	≤ LOD	-1	-1	*	*	*
Jan-11	29.67	401	498	97	*	*	*	*	3	-7	-10	*	*	*
	29.95	346	453	107	*	*	2	17	3	-7	-10	*	*	35
	29.84	299	401	102	*	*	*	*	3	-7	-10	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

Date	Tunnel	Low-Level Chamber					Filter		Control Chamber					Filter (PM)
	NO_x (ppb)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM ($\mu g/m^3$)	PASS ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Feb-11	38.22	467	583	117	*	*	*	*	1	-22	-24	*	*	*
	38.05	323	414	91	*	*	2	25	1	-23	-24	*	*	21
	37.85	423	528	105	*	*	*	*	1	-21	-23	*	*	*
Mar-11	41.20	466	564	98	*	*	*	*	2	-12	-13	*	*	*
	40.83	513	615	102	*	*	1	27	2	-12	-14	*	*	33
	41.14	732	837	105	*	*	*	*	2	-12	-13	*	*	*
Apr-11	41.80	507	617	110	*	*	*	*	2	-11	-13	*	*	*
	41.75	589	703	114	0.4	≤ LOD	2	15	2	-11	-13	0.4	-0.1	8
	42.04	663	774	111	*	*	*	*	2	-11	-13	*	*	*
May-11	40.38	235	335	100	*	*	*	*	-3	-14	-11	*	*	*
	39.76	267	370	104	0.2	-0.1	2	14	-3	-14	-11	*	*	21
	40.30	260	362	102	*	*	*	*	-3	-14	-11	*	*	*
Jun-11	28.29	226	325	99	*	*	*	*	1	-7	-7	*	*	*
	28.24	253	352	99	*	*	2	16	1	-6	-7	*	*	14
	28.48	239	343	105	*	*	*	*	≤ LOD	-7	-7	*	*	*
Jul-11	24.05	414	508	94	*	*	*	*	-1	-14	-14	*	*	*
	24.08	439	532	96	*	*	1	18	-2	-17	-14	*	*	11
	24.13	458	553	96	*	*	*	*	6	-6	-12	*	*	*
Aug-11	28.52	1166	1257	92	*	*	*	*	2	-45	-47	*	*	*
	28.88	968	1058	91	*	*	1	10	3	-43	-46	*	*	14
	29.10	1234	1329	97	*	*	*	*	2	-44	-47	*	*	*
Sep-11	29.56	718	830	119	*	*	*	*	3	5	1	*	*	*
	30.13	599	701	103	*	*	2	21	3	4	≤ LOD	*	*	21
	29.94	861	963	108	*	*	*	*	4	3	≤ LOD	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

Date	Tunnel	Low-Level Chamber					Filter		Control Chamber					Filter (PM)
	NO_x (ppb)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM ($\mu g/m^3$)	PASS ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Oct-11	31.09	293	399	106	*	*	*	*	2	1	-1	*	*	*
	31.52	262	363	101	*	*	2	23	2	1	-1	*	*	37
	31.72	298	400	103	*	*	*	*	2	1	-1	*	*	*
Nov-11	34.24	283	390	108	*	*	*	*	-1	-5	-4	*	*	*
	34.24	266	366	101	*	*	1	20	-1	-4	-3	*	*	23
	33.97	308	408	100	*	*	*	*	-1	-5	-4	*	*	*
Dec-11	31.68	227	318	92	*	*	*	*	-3	-7	-5	*	*	*
	31.83	264	366	102	*	*	1	25	-2	-5	-3	*	*	11
	30.76	344	445	101	*	*	*	*	-2	-6	-4	*	*	*
Jan-12	32.68	252	357	104	*	*	*	*	≤ LOD	-1	-1	*	*	*
	32.35	305	407	103	*	*	1	13	≤ LOD	-1	-1	*	*	17
	32.53	329	433	104	*	*	*	*	≤ LOD	-1	-1	*	*	*
Feb-12	33.93	361	459	98	*	*	*	*	-2	-8	-6	*	*	*
	34.00	375	478	103	*	*	1	23	-2	-8	-6	*	*	26
	33.52	437	542	105	*	*	*	*	-3	-9	-7	*	*	*
Mar-12	35.20	484	589	106	*	*	*	*	≤ LOD	-2	-1	*	*	*
	35.19	483	585	102	*	*	3	29	≤ LOD	-1	-1	*	*	33
	35.13	516	617	101	*	*	*	*	≤ LOD	-1	-1	*	*	*
Apr-12	33.33	479	601	122	*	*	*	*	-1	≤ LOD	≤ LOD	*	*	*
	33.23	451	545	94	*	*	5	32	-1	≤ LOD	1	*	*	16
	33.02	506	602	97	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
May-12	31.33	326	427	101	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	31.38	422	525	103	*	*	2	65	≤ LOD	≤ LOD	≤ LOD	*	*	10
	31.14	479	583	104	*	*	*	*	1	1	≤ LOD	*	*	*

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection

Exposure Summary for Routine Monitoring of Exposure Atmospheres (Total) (Cont.)

Date	Tunnel	Low-Level Chamber					Filter		Control Chamber					Filter (PM)
	NO_x (ppb)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM ($\mu g/m^3$)	PASS ($\mu g/m^3$)	Inlet ($\mu g/m^3$)	Chamber ($\mu g/m^3$)	NO (ppb)	NO_x (ppb)	NO_2 (ppb)	DMM (PM) ($\mu g/m^3$)	PASS (EC) ($\mu g/m^3$)	Chamber ($\mu g/m^3$)
Jun-12	29.17	353	451	98	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	29.09	391	493	102	*	*	2	13	≤ LOD	≤ LOD	≤ LOD	*	*	30
	28.91	461	566	105	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Jul-12	24.04	647	721	74	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	24.11	558	649	91	*	*	2	14	≤ LOD	≤ LOD	≤ LOD	*	*	29
	24.24	624	687	74	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Aug-12	27.95	1176	1184	67	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	28.21	821	849	64	*	*	1	20	≤ LOD	≤ LOD	≤ LOD	*	*	17
	28.07	1115	1125	100	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Sep-12	30.15	*	*	*	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
	30.85	1054	1159	132	*	*	3	33	≤ LOD	≤ LOD	≤ LOD	*	*	21
	30.67	1326	1416	90	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Oct-12	30.10	750	842	110	*	*	10	50	≤ LOD	≤ LOD	≤ LOD	*	*	64
	30.11	1105	1168	147	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Nov-12	26.35	355	458	103	*	*	25	43	≤ LOD	≤ LOD	≤ LOD	*	*	24
	26.57	708	830	143	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
Dec-12	24.96	484	627	143	*	*	20	74	≤ LOD	≤ LOD	≤ LOD	*	*	51
	25.14	469	551	82	*	*	*	*	≤ LOD	≤ LOD	≤ LOD	*	*	*
average	30.28	438	539	105	0.3	-0.1	3	25	1	-4	-5	0.4	-0.1	27
stdev	5.17	278	268	15	0.2	≤ LOD	5	16	4	14	12	*	*	16
%cv	17.1%	63.5%	49.8%	14.2%	60.4%	-54.5%	160.4%	62.7%	330.3%	-383.8%	-255.2%	*	*	61.6%
min	21.04	79	180	64	0.2	-0.1	1	10	-3	-45	-47	0.4	-0.1	8
max	42.04	1326	1416	147	0.4	≤ LOD	25	74	20	55	39	0.4	-0.1	77
%target				**105%**										

NO_x = oxides of nitrogen, NO= Nitrogen monoxide. NO_2 = nitrogen dioxide. CO_2 = carbon dioxide, CO = carbon monoxide, HC= hydrocarbon, SO_2 = sulfur dioxide; DMM = Dekati mass monitor, PASS = photoacoustic soot monitor.
*No data were collected during that period due to study design or instrument failure.
LOD = Limit of Detection