



APPENDIX AVAILABLE ON REQUEST

Research Report 143

Measurement and Modeling of Exposure to Selected Air Toxics for Health Effects Studies and Verification by Biomarkers

Roy M. Harrison et al.

Appendix 16. Urinary Biomarkers Concentrations Statistics Summary

Note: Appendices Available on the Web appear in a different order than in the original Investigators' Report. HEI has not changed these documents.

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APPENDIX 16: URINARY BIOMARKERS CONCENTRATIONS STATISTICS SUMMARY

Table A16.1. Characterisation of urinary biomarkers

COMPOUND	N	Min	25%	50%	75%	Max	Mean	SD	LB ^a	UB ^b	GM	GSD	GLB ^c	GUB ^d
Creatinine	94	18.10	67.00	110.0	159.3	261.8	117.3	53.77	106.1	128.5	125.4	1.51	113.3	138.9
Cotinine	94	0.30	0.20	0.70	4.18	35.00	3.78	7.02	2.32	5.25	0.95	5.20	0.63	1.43
Cotinine/Creatinine	94	0.20	1.20	3.80	22.55	313.2	24.67	50.89	14.07	35.27	4.39	5.22	2.92	6.59
Trans-3-Hydroxycotinine	94	0.20	1.10	2.95	11.25	63.30	9.96	15.33	6.77	13.15	3.96	4.52	2.73	5.73
Trans-3-Hydroxycotinine/Creatinine	94	0.90	4.65	13.10	59.95	539.5	49.66	79.46	33.11	66.21	16.49	4.34	11.50	23.66
2-Naphtol	94	0.30	1.58	2.80	4.83	33.20	4.67	5.57	3.51	5.83	3.62	2.35	2.93	4.47
2-Naphtol/Creatinine	94	4.50	11.53	20.15	28.05	230.2	27.48	29.41	21.35	33.60	20.04	2.09	16.72	24.02
1-Hydroxyfluorene	94	0.10	0.10	0.10	0.20	0.70	0.23	0.21	0.08	0.37	0.17	2.08	0.10	0.28
1-Hydroxyfluorene/creatinine	94	0.00	0.40	0.50	1.50	3.20	1.02	0.95	0.38	1.66	0.73	2.25	0.42	1.26
2-Hydroxyfluorene	94	0.40	0.90	1.30	1.80	17.90	0.37	0.40	0.29	0.45	0.35	1.98	0.29	0.41
2-Hydroxyfluorene/creatinine	94	0.00	0.20	0.20	0.50	3.30	1.91	2.40	1.41	2.41	1.51	1.91	1.29	1.77
3-Hydroxyfluorene	94	0.20	0.10	0.20	0.20	1.00	0.21	0.19	0.15	0.28	0.18	1.76	0.15	0.22
3-Hydroxyfluorene/creatinine	94	0.20	0.50	0.70	0.90	5.30	0.99	1.05	0.65	1.33	0.74	2.07	0.58	0.94
1-Hydroxyphenanthrene	94	0.00	0.10	0.20	0.40	1.40	0.30	0.31	0.24	0.37	0.27	2.19	0.22	0.33
1-Hydroxyphenanthrene/creatinine	94	0.30	0.60	0.90	1.40	8.00	1.35	1.30	1.08	1.62	1.14	2.05	0.95	1.35
2-Hydroxyphenanthrene	94	0.00	0.08	0.10	0.20	0.50	0.13	0.11	0.10	0.15	0.14	1.67	0.13	0.16
2-Hydroxyphenanthrene/creatinine	94	0.10	0.30	0.40	0.70	4.60	0.57	0.54	0.46	0.68	0.52	1.81	0.45	0.60
3+4-Hydroxyphenanthrene	94	0.00	0.10	0.20	0.40	2.70	0.31	0.38	0.23	0.38	0.27	2.12	0.23	0.23
3+4-Hydroxyphenanthrene/creatinine	94	0.30	0.70	1.00	1.40	11.30	1.40	1.59	0.46	1.73	1.17	1.97	0.99	1.38
1-Hydroxypyrene	94	0.00	0.10	0.10	0.20	1.20	0.14	0.15	0.10	0.17	0.14	1.69	0.13	0.16
1-Hydroxypyrene/Creatinine	94	0.10	0.30	0.40	0.55	3.00	0.52	0.41	0.43	0.60	0.49	1.69	0.43	0.55

a) LB, Arithmetic Lower Bound, 95% CI. b) UB, Arithmetic Upper Bound, 95% CI, c) GLB, Geometric Lower Bound, 95% CI d) GUB, Geometric Upper Bound, 95% CI

Table A16.2. Characterisation of urinary biomarkers, ETS Exposed

COMPOUND	N	Min	25%	50%	75%	Max	Mean	SD	LB ^a	UB ^b	GM	GSD	GLB ^c	GUB ^d
Creatinine	33	32.50	67.35	106.0	141.9	214.0	109.6	49.78	92.03	127.3	128.3	1.38	111.1	148.1
Cotinine	33	0.40	2.75	5.90	11.70	35.00	8.98	9.56	5.59	12.37	4.54	4.12	2.42	8.50
Cotinine/Creatinine	33	0.50	17.85	29.30	91.00	313.2	59.92	71.85	34.44	85.39	20.16	4.32	10.54	38.57
Trans-3-Hydroxycotinine	33	0.50	6.65	12.30	30.65	63.30	20.78	19.57	13.85	27.72	14.41	3.45	8.32	24.96
Trans-3-Hydroxycotinine/Creatinine	33	2.10	36.30	70.60	151.0	539.5	106.7	105.7	69.28	144.2	58.69	3.53	33.54	102.7
2-Naphtol	33	0.50	1.70	2.50	4.45	15.40	3.71	3.35	2.52	4.90	3.54	2.01	2.60	4.83
2-Naphtol/Creatinine	33	7.30	12.35	20.00	27.05	81.30	23.16	15.48	17.67	28.65	19.17	1.86	14.57	25.23
1-Hydroxyfluorene	33	0.20	0.20	0.20	0.20	0.20	0.87	0.55	-	2.23	0.16	2.38	0.08	0.33
1-Hydroxyfluorene/creatinine	33	0.00	0.50	0.60	1.50	1.50	0.23	0.06	0.09	0.38	0.72	2.50	0.33	1.55
2-Hydroxyfluorene	33	0.10	0.20	0.20	0.45	0.90	0.31	0.20	0.24	0.38	0.31	1.74	0.24	0.40
2-Hydroxyfluorene/creatinine	33	0.60	0.90	1.30	1.70	8.00	1.78	1.64	1.20	2.37	1.30	1.63	1.05	1.61
3-Hydroxyfluorene	33	0.20	0.20	0.20	0.20	0.30	0.90	0.61	-	2.41	0.27	2.64	0.12	0.60
3-Hydroxyfluorene/creatinine	33	0.20	0.50	0.60	1.15	3.40	0.00	0.00	0.00	1.12	3.20	0.42	2.95	0.41
1-Hydroxyphenanthrene	33	0.00	0.10	0.10	0.40	1.40	0.32	0.39	0.18	0.46	0.26	2.64	0.17	0.41
1-Hydroxyphenanthrene/creatinine	33	0.40	0.50	1.00	1.85	8.00	1.41	1.47	0.89	1.93	1.14	2.30	0.79	1.66
2-Hydroxyphenanthrene	33	0.00	0.05	0.10	0.15	0.50	0.13	0.13	0.08	0.17	0.15	1.78	0.11	0.19
2-Hydroxyphenanthrene/creatinine	33	0.20	0.30	0.50	0.60	2.20	0.56	0.42	0.42	0.71	0.50	1.89	0.38	0.66
3+4-Hydroxyphenanthrene	33	0.10	0.10	0.20	0.35	2.70	0.36	0.57	0.16	0.57	0.28	2.64	0.18	0.18
3+4-Hydroxyphenanthrene/creatinine	33	0.40	0.70	1.00	1.40	11.30	1.64	2.20	0.42	2.42	1.19	2.29	0.83	1.72
1-Hydroxypyrene	33	0	0.1	0.1	0.2	1.2	0.15	0.20	0.07	0.22	0.15	1.82	0.11	0.19
1-Hydroxypyrene/Creatinine	33	0.2	0.3	0.4	0.5	2.6	0.52	0.42	0.37	0.67	0.47	1.70	0.37	0.60

a) LB, Arithmetic Lower Bound, 95% CI. b) UB, Arithmetic Upper Bound, 95% CI, c) GLB, Geometric Lower Bound, 95% CI d) GUB, Geometric Upper Bound, 95% CI

Table A16.3. Characterisation of urinary biomarkers, Non-ETS exposed

COMPOUND	N	Min	25%	50%	75%	Max	Mean	SD	LB ^a	UB ^b	GM	GSD	GLB ^c	GUB ^d
Creatinine	61	18.10	66.60	114.4	160.6	261.8	121.7	55.86	107.0	136.4	124.1	1.58	108.0	142.5
Cotinine	61	0.30	0.20	0.30	0.75	6.70	0.83	1.41	0.46	1.20	0.44	3.07	0.31	0.61
Cotinine/Creatinine	61	0.20	0.95	1.50	4.45	36.70	4.62	7.88	2.54	6.69	2.05	3.13	1.45	2.90
Trans-3-Hydroxycotinine	61	0.20	0.60	1.60	3.35	41.10	3.80	7.05	1.94	5.65	2.07	3.27	1.45	2.97
Trans-3-Hydroxycotinine/Creatinine	61	0.90	3.30	6.50	14.75	140.3	17.17	27.14	10.03	24.30	8.74	3.05	6.23	12.26
2-Naphtol	61	0.30	1.40	3.20	5.75	33.20	5.21	6.47	3.51	6.91	3.66	2.53	2.76	4.85
2-Naphtol/Creatinine	61	4.50	10.75	20.20	34.75	230.2	29.93	34.84	20.77	39.09	20.49	2.21	16.10	26.09
1-Hydroxyfluorene	61	0.10	0.10	0.10	0.48	0.70	0.24	0.26	0.02	0.45	0.16	2.38	0.08	0.33
1-Hydroxyfluorene/creatinine	61	0.10	0.33	0.50	2.00	3.20	1.08	1.09	0.16	1.99	0.72	2.50	0.33	1.55
2-Hydroxyfluorene	61	0.40	0.80	1.30	1.90	17.90	1.99	2.75	1.26	2.71	1.63	2.02	1.32	2.02
2-Hydroxyfluorene/creatinine	61	0.00	0.10	0.20	0.40	1.30	0.29	0.26	0.23	0.36	0.27	1.99	0.22	0.34
3-Hydroxyfluorene	61	0.20	0.10	0.20	0.20	1.00	0.40	0.37	0.09	0.71	0.27	2.64	0.12	0.60
3-Hydroxyfluorene/creatinine	61	0.20	0.40	0.70	0.90	5.30	1.86	1.79	0.36	3.36	1.12	3.20	0.42	2.95
1-Hydroxyphenanthrene	61	0.00	0.10	0.20	0.40	1.30	0.29	0.26	0.23	0.36	0.27	1.99	0.22	0.34
1-Hydroxyphenanthrene/creatinine	61	0.30	0.70	0.90	1.40	6.30	1.32	1.21	1.00	1.63	1.13	1.94	0.93	1.38
2-Hydroxyphenanthrene	61	0.00	0.05	0.10	0.20	0.50	0.12	0.10	0.10	0.15	0.14	1.62	0.12	0.16
2-Hydroxyphenanthrene/creatinine	61	0.10	0.30	0.40	0.70	4.60	0.57	0.60	0.41	0.73	0.53	1.78	0.45	0.63
3+4-Hydroxyphenanthrene	61	0.00	0.10	0.20	0.40	0.70	0.27	0.19	0.22	0.32	0.27	1.87	0.23	0.23
3+4-Hydroxyphenanthrene/creatinine	61	0.30	0.70	1.00	1.40	6.20	1.26	1.12	0.41	1.56	1.16	1.83	0.97	1.39
1-Hydroxypyrene	61	0	0.1	0.1	0.2	0.4	0.13	0.11	0.10	0.16	0.14	1.64	0.12	0.17
1-Hydroxypyrene/Creatinine	61	0.1	0.3	0.45	0.6	3	0.52	0.41	0.41	0.63	0.49	1.69	0.42	0.58

a) LB, Arithmetic Lower Bound, 95% CI. b) UB, Arithmetic Upper Bound, 95% CI, c) GLB, Geometric Lower Bound, 95% CI d) GUB, Geometric Upper Bound, 95% CI

APPENDIX 16: URINARY BIOMARKERS CONCENTRATIONS STATISTICS SUMMARY

Table A16.7. Correlation of urinary biomarkers with PAH personal exposure Log database, Pearson coefficient

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acenaphthylene	0.29	0.27	0.28	0.28	0.21	0.22	0.13	0.36	0.57	0.45	0.23	0.30	0.30	0.33	0.14	0.36	0.37	0.37	0.11	0.47
Acenaphthene	-0.02	0.02	-0.07	-0.01	-0.18	-0.10	0.12	0.09	-0.01	0.09	0.37	0.18	-0.02	0.03	-0.13	0.00	0.04	0.14	0.10	0.00
Fluorene	-0.23	-0.26	0.11	0.07	-0.73	-0.78	(a)	(a)	-0.26	-0.33	0.33	0.05	0.53	0.29	-0.05	-0.07	-0.13	-0.11	0.48	0.30
Phenanthrene	0.11	0.13	0.04	0.09	-0.13	-0.06	0.05	0.40	0.12	0.22	0.26	0.29	-0.12	0.01	-0.01	0.09	0.22	0.24	0.10	0.24
Anthracene	0.17	0.13	0.13	0.09	0.19	0.12	0.31	0.54	0.30	0.30	0.17	0.15	0.00	0.01	0.03	0.12	0.37	0.35	0.16	0.27
Fluoranthene	0.23	0.20	0.25	0.22	0.00	-0.06	0.18	0.31	0.15	0.13	0.07	0.05	0.09	0.17	0.09	0.20	0.24	0.23	0.03	0.23
Pyrene	0.07	0.02	0.09	0.03	0.17	0.10	0.18	0.31	0.31	0.24	0.16	0.04	0.17	0.16	0.15	0.22	0.30	0.21	0.18	0.26
Benzo(a)anthracene	0.35	0.28	0.32	0.25	0.20	0.11	0.14	-0.12	0.17	0.13	0.20	0.19	0.14	0.03	0.00	0.10	0.15	0.04	-0.12	0.00
Chrysene	0.55	0.44	0.52	0.43	0.30	0.15	0.36	0.17	0.28	0.21	0.24	0.09	0.13	0.01	0.13	0.13	0.24	0.06	0.11	0.12
Benzo(b)fluoranthene	0.42	0.38	0.38	0.34	0.15	0.06	0.20	0.13	0.17	0.18	0.22	0.13	-0.01	-0.08	0.01	0.04	-0.01	-0.05	0.10	0.20
Benzo(k)fluoranthene	0.45	0.38	0.42	0.38	0.16	0.08	0.30	0.21	0.26	0.21	0.27	0.13	0.04	0.01	0.11	0.08	0.22	0.13	0.15	0.19
Benzo(a)pyrene	0.38	0.30	0.36	0.29	0.22	0.10	0.08	-0.01	0.28	0.23	0.22	0.12	0.03	0.00	0.09	0.12	0.18	0.04	0.14	0.18
Indeno(1,2,3-cd)pyrene	0.06	0.04	0.09	0.07	0.16	0.15	0.14	0.14	0.14	0.18	0.16	0.30	0.19	0.18	0.22	0.23	0.21	0.14	0.05	0.14
Dibenz(a,h)anthracene	0.37	0.29	0.32	0.25	0.08	-0.08	0.24	0.12	0.07	0.00	0.17	0.11	0.04	-0.06	0.10	0.02	0.06	-0.08	0.00	-0.12
Benzo(ghi)perylene	0.30	0.23	0.31	0.28	0.20	0.11	0.07	0.02	0.16	0.12	0.14	0.13	-0.04	-0.03	0.02	0.06	0.07	-0.05	0.12	0.12
Coronene	0.23	0.19	0.21	0.19	0.01	-0.03	-0.02	-0.04	0.06	0.06	0.16	0.09	-0.11	-0.11	0.12	-0.02	0.01	-0.06	0.06	0.07
3-Ethenyl Pyridine	0.76	0.74	0.84	0.88	-0.09	-0.07	0.05	0.05	-0.02	0.12	0.10	0.11	-0.05	-0.02	0.01	0.08	-0.01	0.09	-0.08	0.10
Naphthalene (gas phase)	0.05	0.05	-0.05	-0.03	0.03	0.08	0.09	0.18	0.00	0.12	0.15	0.12	-0.10	-0.13	-0.20	-0.02	-0.07	-0.03	-0.06	0.01
1,3-Butadiene	0.47	0.43	0.44	0.42	0.07	0.03	0.07	0.01	0.15	0.10	0.06	-0.03	-0.03	-0.09	0.00	-0.06	0.05	0.00	0.15	0.23
Sum of low MW PAH [Naph - An]	0.17	0.16	0.11	0.14	-0.08	-0.06	0.14	0.49	0.08	0.18	0.34	0.27	-0.02	0.09	-0.08	0.11	0.18	0.23	0.08	0.12
Sum of medium MW PAH [Fluo - Chry]	0.27	0.18	0.31	0.23	0.33	0.21	0.21	0.28	0.28	0.25	0.10	0.14	0.13	0.06	0.04	0.17	0.12	0.01	0.06	0.17
Sum of high MW PAH [B(b)F - Cor]	0.37	0.28	0.37	0.31	0.24	0.13	0.15	0.09	0.21	0.15	0.20	0.16	0.02	-0.01	0.07	0.04	0.13	-0.01	0.15	0.09
Sum of 16PAH [Naph - B(ghi)P]	0.26	0.17	0.31	0.22	0.24	0.10	0.24	0.38	0.25	0.24	0.20	0.16	0.11	0.09	0.00	0.19	0.15	0.04	0.13	0.20

Bold cells: Correlation is significant at the 0.05 level (2-tailed)

1. Cotinine; 2. Cotinine/ creatinine; 3. Trans-3'-Hydroxycotinine; 4. Trans-3'-Hydroxycotinine/ creatinine;
5. 2-Naphthol; 6. 2-Naphthol/ creatinine; 7. 1-Hydroxyfluorene; 8. 1-Hydroxyfluorene/ creatinine;
9. 2-Hydroxyfluorene; 10. 2-Hydroxyfluorene/ creatinine; 11. 3-Hydroxyfluorene; 12. 3-Hydroxyfluorene/ creatinine;
13. 1-Hydroxyphenanthrene; 14. 1-Hydroxyphenanthrene/ creatinine; 15. 2-Hydroxyphenanthrene;
16. 2-Hydroxyphenanthrene/ creatinine; 17. 3- + 4-Hydroxyphenanthrene;
18. 3- + 4-Hydroxyphenanthrene/ creatinine; 19. 1-Hydroxypyrene; 20. 1-Hydroxypyrene/ creatinine