

# Supplementary Materials: Source Apportionment and Health Risk Assessment of Heavy Metals in PM<sub>2.5</sub> in Handan: A Typical Heavily Polluted City in North China

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**Table S1.** Parameters of population exposure evaluation model.

Group	ET	EF	ED	AT(non-carcinogen)	AT(carcinogens)
Adult	8	250	24	$24 \times 24 \times 365$	$24 \times 70 \times 365$
Children	8	350	6	$24 \times 6 \times 365$	$24 \times 70 \times 365$

**Table S2.** Response parameters of elements entering the human body through the respiratory system.

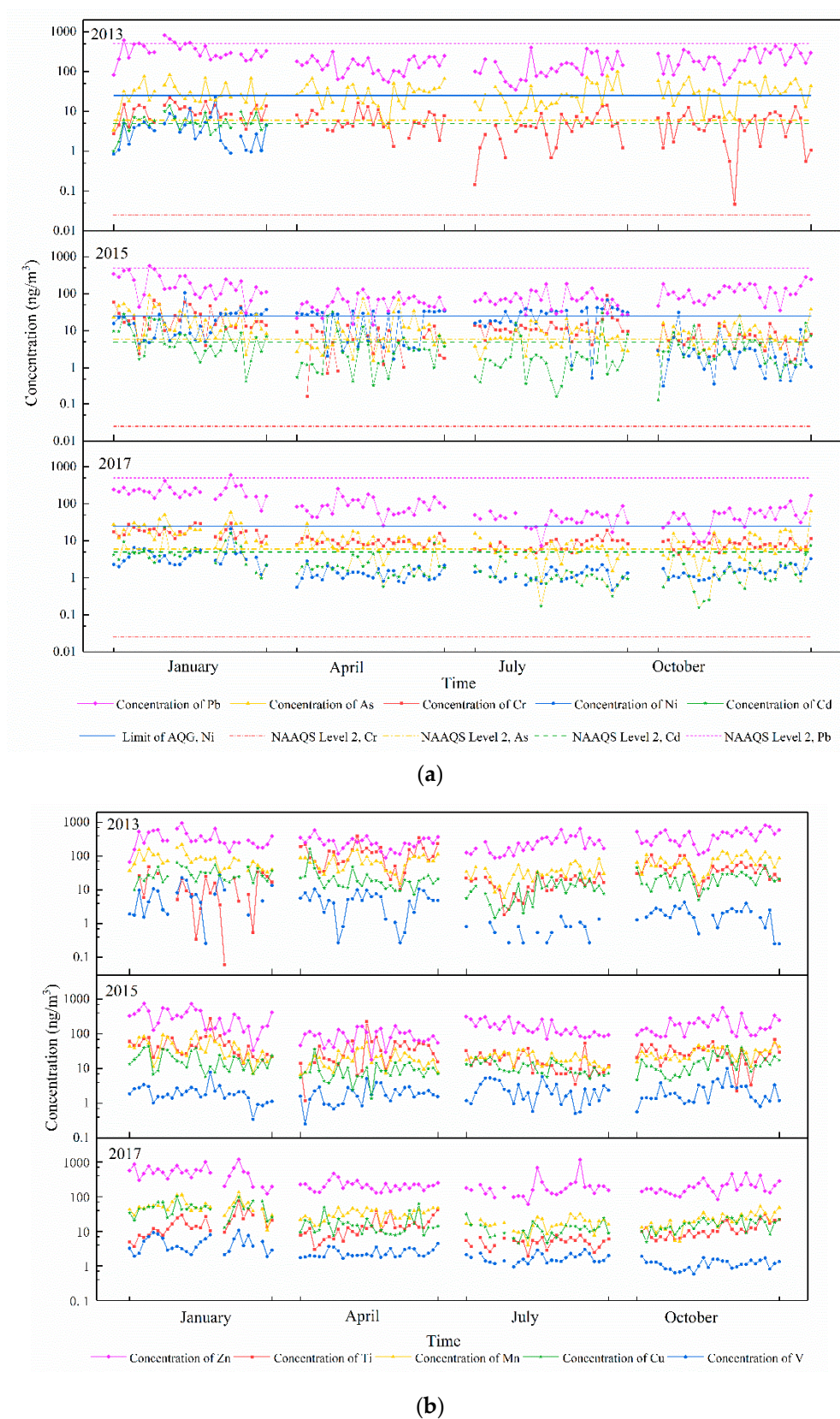
Elements	RfC (mg/m <sup>3</sup> )	IUR (μg/m <sup>3</sup> ) <sup>-1</sup>
V	$1.00 \times 10^{-2}$	na <sup>*</sup>
Cr	$1.00 \times 10^{-1}$	$8.40 \times 10^{-2}$
Mn	$1.00 \times 10^{-1}$	na
Ni	$5.00 \times 10^{-2}$	$2.40 \times 10^{-4}$
As	$1.40 \times 10^{-2}$	$4.30 \times 10^{-3}$
Cd	$1.50 \times 10^{-2}$	$1.80 \times 10^{-3}$
Pb	na	$8.00 \times 10^{-5}$

\*not available.

**Table S3.** Monthly average concentration of 10 metal elements (ng/m<sup>3</sup>).

Year	Month	Ti	V	Cr	Mn	Ni	Cu	Zn	As	Cd	Pb
2013	January	11.78	6.09	10.36	81.94	4.37	29.08	348.23	31.4	5.67	360.19
	April	124.46	4.96	5.55	70.87		23.99	259.55	29.3		155.32
	July	16.04	0.41	4.51	33.41		11.18	248.12	28.25		150.04
	October	45.14	1.73	5.34	73.14		22.63	411.22	35.61		231.15
	Average	49.35	3.3	6.44	64.84	3.7	21.72	316.78	31.14	5.67	224.17
	C·V	1.34	1.41	0.73	0.63	1.07	0.86	0.58	0.67	0.57	0.68
2015	January	53.38	2.08	25.31	43.82	20.9	18.64	307.57	23.24	7.49	203.28
	April	38.4	1.96	3.98	19.76	20.1	9.15	88.61	13.81	4.77	61.71
	July	17.02	2.43	14.64	20.08	27.65	11.06	161.73	7.52	3.13	75.43
	October	29.71	2.33	6.63	29.51	3.67	15.12	193.14	9.32	4	119.54
	Average	34.62	2.2	12.64	28.29	18.08	13.5	187.76	13.47	4.85	114.99
	C·V	1.02	0.66	1.14	0.67	0.91	0.66	0.75	1.1	1.3	0.82
2017	January	19.25	4.63	18.44	54.56	4.33	47.78	514.3	21.66	5.79	228.89
	April	14.4	2.4	9.44	32.06	1.33	16.77	214.89	9.94	2.17	93.91
	July	4.97	1.7	8.38	16.86	1.24	11.92	214.98	5.86	1.16	41.93
	October	11.87	1.15	8.16	22.7	1.53	16.23	203.31	10.31	1.82	52.3
	Average	12.62	2.47	11.11	31.55	2.11	23.17	286.87	11.94	2.74	104.26
	C·V	0.91	0.81	0.57	0.73	1.12	0.90	0.81	0.95	1.20	0.96
Limit value		-	-	0.025 <sup>a</sup>	-	25 <sup>b</sup>	-	-	6 <sup>a</sup>	5 <sup>a</sup>	500 <sup>a</sup>

<sup>a</sup> reference from CAAQS; <sup>b</sup> reference from WHO



**Figure S1.** (a) Mass concentration of Cr, Ni, As, Cd, Pb in Handan during sampling period and limits of CAAQS and AQG. (b) Mass concentration of Zn, Ti, Mn, Cu, V in PM<sub>2.5</sub> during sampling period.