Supplementary Material

Spatiotemporal characteristics and Monte Carlo simulation-based human health risk of heavy metals in soils from a typical coal-mining city in eastern China

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Tab. S1 Statistical summary of potential heavy metal content (mean value) in soils near Huainan mining area (mg kg^{-1}).

No.	Cd	Cr	Hg	As	Pb	Cu	Zn	Ni	Mn	Sample No.	Soil use types	Year	Location	References
1	0.39									16	Agricultural soil	2018	China, Huainan	1
2	0.11	70.39	0.03	14.76	26.18	31.83	62.93	33.54		50	Agricultural soil	2021	China, Huainan	2
3	0.10	77.30	0.10	8.20	31.00	25.00				6	Agricultural soil	2021	China, Huainan	3
4	0.11	79.90	0.04	9.90	27.50	26.00				17	Agricultural soil	2021	China, Huainan	3
5	0.09	92.20	0.03	10.40	28.30	29.40				8	Residential soil	2021	China, Huainan	3
6	0.17	77.40	0.05	8.70	31.00	31.10				9	Agricultural soil	2021	China, Huainan	3
7	0.15	82.40	0.04	10.50	29.10	27.30				19	Agricultural soil	2021	China, Huainan	3
8	0.13	79.70	0.04	10.40	30.20	27.40				12	Residential soil	2021	China, Huainan	3
9	0.25			18.94	26.40	25.23	67.68			80	Agricultural soil	2017	China, Huainan	4
10										12	Mining area soil	2021	China, Huainan	5
11	0.13	82.34	0.04	20.53	25.17	34.63	94.50	37.81		21	Agricultural soil	2021	China, Huainan	6
12	0.18	106.20	0.08	21.05	29.94	50.69	117.94	50.29		21	Agricultural soil	2021	China, Huainan	6
13	0.12	93.14	1.42	26.99	31.41	38.82	107.80	44.05		21	Agricultural soil	2021	China, Huainan	6
14		131.28		16.53		46.55	157.20	30.18		269	Mining area soil	2016	China, Huainan	8
15		73.09				28.35	59.66	24.58	613.60	9	Agricultural soil	2018	China, Huainan	9
16			0.02							10	Mining area soil	2020	China, Huainan	10
17	1.51				31.30	25.76	71.14			15	Mining area soil	2020	China, Huainan	11
18	2.71				45.20	40.94	119.74			15	Mining area soil	2020	China, Huainan	11
19	0.07				20.14	12.91		13.51		10	Agricultural soil	2020	China, Huainan	12
20	0.58	42.32			35.32	23.79	287.51	29.28		8	Agricultural soil	2017	China, Huainan	13
21	0.55	32.84			29.67	19.50	278.30	25.11		8	Agricultural soil	2017	China, Huainan	13

22	0.46	27.61			33.36	20.10	274.43	31.01		8	Agricultural soil	2017	China, Huainan	13
23	0.53	26.37			38.56	20.46	287.51	30.80		8	Natural soil	2019	China, Huainan	14
24	0.41	21.30			35.28	23.54	278.30	31.55		8	Natural soil	2019	China, Huainan	14
25	0.37	20.86			39.41	21.24	274.43	42.15		7	Natural soil	2019	China, Huainan	14
26	1.20	195.75			43.62	39.23	241.85	40.34		8	Agricultural soil	2019	China, Huainan	14
27	1.20	222.52			43.46	34.38	223.75	40.92		8	Agricultural soil	2019	China, Huainan	14
28	1.18	204.53			47.25	39.46	232.30	39.99		8	Agricultural soil	2019	China, Huainan	14
29	0.04			8.88						26	Urban soil	2019	China, Huainan	15
30	0.05			10.30						16	Woodland soil	2019	China, Huainan	15
31	0.04			7.91						9	Agricultural soil	2019	China, Huainan	15
32	0.04			7.32						48	Agricultural soil	2019	China, Huainan	15
33	0.14				75.74	10.40	73.26			3	Agricultural soil	2017	China, Huainan	17
34					50.52					269	Mining area soil	2019	China, Huainan	18
35	0.25			18.94	26.39	25.23	67.68			16	Agricultural soil	2017	China, Huainan	19
36			0.04							9	Agricultural soil	2016	China, Huainan	20
37			0.02							11	Mining area soil	2016	China, Huainan	20
38			0.02							10	Mining area soil	2016	China, Huainan	20
39			0.02							4	Mining area soil	2016	China, Huainan	20
40	0.25									16	Agricultural soil	2017	China, Huainan	21
41	0.22									14	Mining area soil	2018	China, Huainan	22
42	2.09									26	Agricultural soil	2018	China, Huainan	22
43	0.11	42.59			14.31	23.08	40.96	20.78	427.87	80	Agricultural soil	2018	China, Huainan	23
44			0.02							5	Mining area soil	2016	China, Huainan	24
45			0.02							5	Mining area soil	2016	China, Huainan	24
46			0.04							9	Mining area soil	2016	China, Huainan	24

47	1.30									22	Agricultural soil	2017	China, Huainan	25
48	1.25									22	Agricultural soil	2017	China, Huainan	25
49	1.38									22	Agricultural soil	2017	China, Huainan	25
50	0.80	286.30			54.78	39.61	333.35	37.98	393.18	60	Agricultural soil	2016	China, Huainan	26
51	0.79	257.99			51.11	41.83	284.81	38.92	393.93	60	Agricultural soil	2016	China, Huainan	26
52	0.89	243.29			51.93	42.20	295.46	38.86	400.89	60	Agricultural soil	2016	China, Huainan	26
53	0.81									36	Agricultural soil	2017	China, Huainan	27
54	0.82									37	Agricultural soil	2017	China, Huainan	27
55	0.74									34	Agricultural soil	2017	China, Huainan	27
56	0.77									26	Agricultural soil	2017	China, Huainan	27
57	0.89									15	Agricultural soil	2017	China, Huainan	27
58	1.06									10	Agricultural soil	2017	China, Huainan	27
59	0.05	46.83			9.95	19.53	27.78	13.87	286.96	6	Mining area soil	2017	China, Huainan	28
60	0.06	54.53			12.27	21.32	28.19	16.59	367.17	6	Mining area soil	2017	China, Huainan	28
61	0.05	64.75			10.89	18.59	26.65	14.53	294.80	6	Mining area soil	2017	China, Huainan	28
62	1.35	131.28	0.10	16.53	50.52	46.55	157.20	30.18		269	Mining area soil	2017	China, Huainan	29
63	0.11	42.59			14.31	23.08	40.96	20.78		80	Mining area soil	2017	China, Huainan	30
64	0.14	46.52			9.40	18.60	31.10	20.45		80	Mining area soil	2017	China, Huainan	30
65	0.14	43.88			8.77	18.31	28.51	20.04		80	Mining area soil	2017	China, Huainan	30
66	0.12				17.09		40.03	19.33	397.42	8	Mining area soil	2017	China, Huainan	31
67	0.11					33.55	80.50			6	Agricultural soil	2014	China, Huainan	32
68	0.09					29.15	67.84			5	Agricultural soil	2014	China, Huainan	32
69	0.07					25.05	63.63			3	Woodland soil	2014	China, Huainan	32
70	0.08					26.77	65.44			3	Woodland soil	2014	China, Huainan	32
71	0.09					28.79	66.96			7	Agricultural soil	2014	China, Huainan	32

72	0.07					25.43	62.72			3	Wasteland soil	2014	China, Huainan	32
73	0.37	71.39		11.97	34.39	29.77	83.90	35.15		12	Mining area soil	2014	China, Huainan	33
74	0.24	69.46		12.91	31.06	28.23	75.18	27.73		12	Mining area soil	2014	China, Huainan	33
75	0.27	61.86		14.67	33.62	22.43	71.79	25.69		12	Mining area soil	2014	China, Huainan	33
76										6	Mining area soil	2017	China, Huainan	34
77	0.27	95.84		37.76	23.43	23.96	80.25			41	Agricultural soil	2016	China, Huainan	35
78	0.11	45.82		27.03	12.20	21.23	39.32	22.94	556.59	25	Agricultural soil	2017	China, Huainan	36
79		75.60	0.02		21.99	14.33	53.59			11	Mining area soil	2014	China, Huainan	37
80		74.12	0.03		24.06	16.19	46.98			11	Mining area soil	2014	China, Huainan	37
81		84.39	0.03		22.38	13.71	51.57			11	Mining area soil	2014	China, Huainan	37
82		108.14	0.03		7.72	17.78	75.74			3	Mining area soil	2014	China, Huainan	37
83		99.88	0.05		8.01	16.46	75.33			3	Mining area soil	2014	China, Huainan	37
84		97.55	0.04		7.60	17.33	69.97			3	Mining area soil	2014	China, Huainan	37
85		119.30	0.02		30.24	19.93	92.99			3	Mining area soil	2014	China, Huainan	37
86		113.03	0.01		13.88	21.44	73.09			3	Mining area soil	2014	China, Huainan	37
87		103.89	0.01		11.12	16.93	74.46			3	Mining area soil	2014	China, Huainan	37
88	0.12	52.70	0.43	12.69	23.41	19.93				1	Agricultural soil	2014	China, Huainan	38
89	0.12	52.21	0.47	7.62	23.27	20.01				1	Agricultural soil	2014	China, Huainan	38
90	0.04	45.38	0.26	12.67	20.63	17.15				1	Agricultural soil	2014	China, Huainan	38
91	0.35	49.74	0.30	10.04	22.05	18.91				1	Agricultural soil	2014	China, Huainan	38
92	0.18	51.65	0.26	10.77	22.75	20.57				1	Agricultural soil	2014	China, Huainan	38
93	0.31	47.64	0.25	9.18	23.74	20.82				1	Agricultural soil	2014	China, Huainan	38
94	0.5	47.42	0.15	11.57	37.88	20.60				1	Agricultural soil	2014	China, Huainan	38
95	0.08	53.24	0.32	8.77	26.82	27.86				1	Agricultural soil	2014	China, Huainan	38
96	0.04	53.41	0.11	10.82	20.03	24.65				1	Agricultural soil	2014	China, Huainan	38

97	0.04	41.41	0.08	10.34	25.25	28.70				1	Agricultural soil	2014	China, Huainan	38
98	0.19	48.60	0.09	11.67	24.39	21.99				1	Agricultural soil	2014	China, Huainan	38
99	0.29	44.67	0.16	9.00	19.36	21.48				1	Agricultural soil	2014	China, Huainan	38
100	0.18	43.13	0.15	9.43	22.56	27.63				1	Agricultural soil	2014	China, Huainan	38
101	0.01	58.46	0.25	15.98	24.95	23.30				1	Agricultural soil	2014	China, Huainan	38
102	0.34	46.66	0.20	10.98	27.55	21.41				1	Agricultural soil	2014	China, Huainan	38
103	0.20	37.81	0.09	6.26	18.29	14.46				1	Agricultural soil	2014	China, Huainan	38
104	0.14	59.33	0.30	14.84	27.16	27.55				1	Agricultural soil	2014	China, Huainan	38
105	0.33	54.38	0.08	18.29	32.79	31.48				1	Agricultural soil	2014	China, Huainan	38
106	0.41	56.61	0.23	12.83	28.38	27.88				1	Agricultural soil	2014	China, Huainan	38
107	0.08	48.68	0.34	23.32	25.35	19.14				1	Agricultural soil	2014	China, Huainan	38
108	0.07	45.27	0.34	9.14	19.46	19.36				1	Agricultural soil	2014	China, Huainan	38
109	0.30	50.41	0.19	12.91	23.67	21.74				1	Agricultural soil	2014	China, Huainan	38
110	0.15	52.73	0.27	12.59	31.29	22.56				1	Agricultural soil	2014	China, Huainan	38
111	0.30	41.97	0.09	30.24	23.54	24.35				1	Agricultural soil	2014	China, Huainan	38
112	0.06	35.46	0.08	10.77	24.39	14.00				1	Agricultural soil	2014	China, Huainan	38
113	0.22	66.16	0.04		17.14	23.62	58.53	22.64	370.73	14	Mining area soil	2013	China, Huainan	39
114	0.19									10	Mining area soil	2015	China, Huainan	39
115	0.14									16	Mining area soil	2015	China, Huainan	39
116	0.16	43.99		43.60	11.56	19.15	34.37			47	Mining area soil	2015	China, Huainan	41
117	1.35		0.10		50.52					269	Mining area soil	2015	China, Huainan	42
118	0.16	130.07		13.74	465.63	45.04				1	Mining area soil	2014	China, Huainan	43
119	0.11	121.83		9.75	736.41	39.52				1	Mining area soil	2014	China, Huainan	43
120	0.14	90.05	0.05	5.11	1125.4	28.65				1	Mining area soil	2014	China, Huainan	43
121	0.32	121.37	0.09	6.04	1349.4	25.44				1	Mining area soil	2014	China, Huainan	43

122	0.10	72.44	0.02	1.32	37.64	5.73				1	Mining area soil	2014	China, Huainan	43
123	0.18	236.38	0.41	5.25	1518.9	87.11				1	Mining area soil	2014	China, Huainan	43
124	0.12	140.21	0.08	5.22	1618.7	33.81				1	Mining area soil	2014	China, Huainan	43
125		95.96		4.11	1688.0	17.71				1	Mining area soil	2014	China, Huainan	43
126	1.97	359.75	0.25		150.00	47.75				42	Mining area soil	2015	China, Huainan	44
127	2.18	393.50	0.33		140.50	66.90				42	Mining area soil	2015	China, Huainan	44
128		72.41	0.04		25.63	25.56		29.88		95	Mining area soil	2011	China, Huainan	45
129	2.06	55.39	0.02		20.01	32.43	88.72		654.56	23	Agricultural soil	2013	China, Huainan	46
130	0.12	69.08	0.06	8.74	25.88	26.27	60.87	28.20		27	Agricultural soil	2014	China, Huainan	47
131		60.02			20.40		597.55	31.65	689.33	29	Agricultural soil	2012	China, Huainan	48
132		65.41			23.31		1526.3	33.41	719.25	11	Agricultural soil	2012	China, Huainan	48
133		58.09			18.48		45.57	30.80	680.02	18	Agricultural soil	2012	China, Huainan	48
134	0.18	58.55		18.57	26.86	28.43	2031.8	32.98	729.51	18	Agricultural soil	2013	China, Huainan	49
135	0.15	43.88			8.75	18.31	28.51	20.04		16	Mining area soil	2014	China, Huainan	50
136	0.04	50.22			13.98	21.00	43.56	23.48		4	Agricultural soil	2010	China, Huainan	51
137	0.06	48.36			13.18	21.35	47.42	23.35		4	Agricultural soil	2010	China, Huainan	51
138	0.01	47.01			14.76	19.36	38.58	19.74		4	Agricultural soil	2010	China, Huainan	51
139	0.31		0.11	5.05	46.67	26.58		33.87	407.77	30	Agricultural soil	2008	China, Huainan	52
140	0.63		0.11	5.55	47.59	31.31		36.89	443.39	30	Agricultural soil	2009	China, Huainan	52
141	0.87		0.11	5.67	53.84	42.05		38.93	409.28	30	Agricultural soil	2010	China, Huainan	52
142							63.96			113	Agricultural soil	2013	China, Huainan	53
143							60.20			113	Agricultural soil	2013	China, Huainan	53
144							61.73			113	Agricultural soil	2013	China, Huainan	53
145	1.48	200.00			37.15	41.04	90.47	38.31		15	Agricultural soil	2013	China, Huainan	54
146	1.37	208.55			36.50	38.17	88.77	37.06		15	Agricultural soil	2013	China, Huainan	54

147	1.11	181.04			35.05	34.70	85.36	37.06		15	Agricultural soil	2013	China, Huainan	54
148	0.91	214.67			53.61	40.99	93.63	35.57		17	Agricultural soil	2013	China, Huainan	54
149	0.86	196.36			45.89	31.74	91.91	36.24		17	Agricultural soil	2013	China, Huainan	54
150	0.87	175.92			51.27	28.41	71.65	35.26		17	Agricultural soil	2013	China, Huainan	54
151	0.80	286.30			54.78	39.61	333.35	37.98	393.18	5	Agricultural soil	2013	China, Huainan	55
152	0.79	257.99			51.11	41.83	284.81	38.92	393.93	5	Agricultural soil	2013	China, Huainan	55
153	0.89	243.29			51.93	42.20	295.46	38.86	400.89	5	Agricultural soil	2013	China, Huainan	55
154	0.91	241.05			53.53	42.38	278.74	38.50		5	Agricultural soil	2013	China, Huainan	55
155	0.95	262.63			57.87	44.21	290.37	40.39		5	Agricultural soil	2013	China, Huainan	55
156	0.53	37.33			32.68	55.44	79.93	54.04		9	Agricultural soil	2013	China, Huainan	55
157	0.41	27.32			41.51	64.32	66.56	64.64		9	Agricultural soil	2013	China, Huainan	55
158	150.37	19.56			42.38	71.56	52.80	68.50		9	Agricultural soil	2013	China, Huainan	55
159	0.31	14.31			49.92	75.31	56.88	67.62		9	Agricultural soil	2013	China, Huainan	55
160	0.44	17.45	0.05		37.61	20.21	342.56	32.27		6	Mining area soil	2011	China, Huainan	56
161	0.39	14.55	0.05		37.27	25.17	342.67	34.11		6	Mining area soil	2011	China, Huainan	56
162	0.20	12.48	0.04		43.56	22.87	348.33	48.50		5	Mining area soil	2011	China, Huainan	56
163	0.29	53.29	0.02		17.80	18.98	332.54	36.73		7	Mining area soil	2011	China, Huainan	56
164	0.27	71.19	0.02		15.74	21.41	354.91	37.73		8	Mining area soil	2011	China, Huainan	56
165	0.46	50.06	0.02		15.12	20.52	347.01	40.21		8	Mining area soil	2011	China, Huainan	56
166	0.43	25.57	0.01	9.53	20.32	19.90	35.80	22.32	289.18	56	Urban soil	2013	China, Huainan	57
167	0.84	39.23	0.01	16.02	27.27	22.23	44.10	30.05	479.69	56	Urban soil	2013	China, Huainan	57
168	0.11	45.82			12.20	21.23	39.32	22.94	556.59	25	Mining area soil	2013	China, Huainan	58
169	0.15	43.88			8.88	18.31	28.51	20.45	299.58	79	Mining area soil	2013	China, Huainan	58
170	0.14	46.52			9.40	18.60	31.10	20.78	404.78	75	Mining area soil	2013	China, Huainan	58
171	0.11	42.59			14.31	23.08	40.96	19.92	427.87	80	Mining area soil	2013	China, Huainan	58

172	0.10	37.80		17.16	17.20	36.81	19.92		3	Agricultural soil	2012	China, Huainan	59
173	0.21	42.34		10.06	16.40	30.59	18.59		16	Mining area soil	2012	China, Huainan	59
174	0.17	46.75		10.13	18.59	32.72	20.29		15	Mining area soil	2012	China, Huainan	59
175	0.14	41.49		13.31	24.24	43.25	20.63		145	Mining area soil	2012	China, Huainan	59
176	0.76	201.38	0.20	44.56	32.67	262.42	42.71	512.76	145	Mining area soil	2009	China, Huainan	60
177	0.62	221.29	0.23	46.59	37.73	168.47	45.07	506.03	145	Mining area soil	2009	China, Huainan	60
178	0.86	207.25	0.25	57.38	32.36	218.26	50.08	504.68	145	Mining area soil	2009	China, Huainan	60
179	0.80	286.30	0.11	54.78	39.61	333.35	37.98	393.18	304	Mining area soil	2009	China, Huainan	60
180	0.79	257.99	0.10	51.11	41.83	284.81	38.92	393.93	304	Mining area soil	2009	China, Huainan	60
181	0.89	243.29	0.11	51.93	42.20	295.46	38.86	400.89	304	Mining area soil	2009	China, Huainan	60
182	0.91	241.05	0.10	53.53	42.38	278.74	38.50	420.75	304	Mining area soil	2009	China, Huainan	60
183	0.95	262.63	0.11	57.87	44.21	290.37	40.39	437.63	304	Mining area soil	2009	China, Huainan	60
184	1.06	186.57	0.32	43.76	44.11	488.21	45.43	534.32	123	Mining area soil	2009	China, Huainan	60
185	1.14	217.77	0.29	45.94	42.85	410.62	48.75	562.29	123	Mining area soil	2009	China, Huainan	60
186	1.05	203.20	0.26	43.60	42.22	461.14	48.55	551.12	123	Mining area soil	2009	China, Huainan	60
187	0.99	55.06		49.40	22.90	83.65	42.01		32	Agricultural soil	2011	China, Huainan	61
188	1.00	57.67		43.25	21.55	85.83	40.99		32	Agricultural soil	2011	China, Huainan	61
189	0.99	55.76		40.30	23.70	80.89	36.49		32	Agricultural soil	2011	China, Huainan	61
190	1.38	215.16		39.76	38.73	90.15	40.66		27	Agricultural soil	2011	China, Huainan	61
191	1.28	196.63		37.05	37.25	88.35	38.86		27	Agricultural soil	2011	China, Huainan	61
192	1.48	226.08		40.43	38.33	86.98	40.23		27	Agricultural soil	2011	China, Huainan	61
193	1.40	211.96		37.46	36.99	88.08	39.35		20	Agricultural soil	2012	China, Huainan	62
194	1.06	195.21		50.17	26.25	75.81	34.14		55	Agricultural soil	2010	China, Huainan	63
195	1.03	166.97		45.93	23.33	62.46	39.32		63	Agricultural soil	2010	China, Huainan	63
196	0.12			14.19	21.89	40.03			16	Mining area soil	2011	China, Huainan	64

197	0.12				15.61	24.27	43.08			16	Mining area soil	2011	China, Huainan	64
198	0.11				13.61	24.18	40.92			16	Mining area soil	2011	China, Huainan	64
199	0.12				14.34	22.19	40.03			16	Mining area soil	2011	China, Huainan	64
200	0.09				13.80	22.88	40.74			16	Mining area soil	2011	China, Huainan	64
201	1.09	50.17			20.38	34.60	64.02	27.36		18	Agricultural soil	2010	China, Huainan	65
202	1.43	59.93			25.90	32.54	62.35	46.65		18	Agricultural soil	2010	China, Huainan	65
203	1.53	73.41			46.93	85.02	42.23	59.21		18	Agricultural soil	2010	China, Huainan	65
204	1.58	78.16			46.26	82.49	36.79	62.59		18	Agricultural soil	2010	China, Huainan	65
205	1.60	76.03			45.48	81.73	39.18	57.26		18	Agricultural soil	2010	China, Huainan	65
206	1.73	75.70			45.25	84.80	39.82	59.21		18	Agricultural soil	2010	China, Huainan	65
207	0.80	286.30	0.11	6.40	54.78	39.61	333.35	37.98	393.18	30	Agricultural soil	2009	China, Huainan	66
208	0.79	257.99	0.10	5.51	51.11	41.83	284.81	38.92	393.93	30	Agricultural soil	2009	China, Huainan	66
209	0.89	243.29	0.11	5.57	51.93	42.20	295.46	38.86	400.89	30	Agricultural soil	2009	China, Huainan	66
210	0.91	241.05	0.10	5.71	53.53	42.38	278.74	38.50	420.75	30	Agricultural soil	2009	China, Huainan	66
211	0.95	262.63	0.28	5.18	57.87	44.21	290.37	40.39	437.63	30	Agricultural soil	2009	China, Huainan	66
212	0.52	172.24	0.30	6.01	42.47	42.70	525.59	45.52		34	Agricultural soil	2009	China, Huainan	67
213	0.57	174.11	0.26	6.05	47.05	42.96	460.31	49.39		34	Agricultural soil	2009	China, Huainan	67
214	0.52	193.59		6.11	44.02	41.90	497.05	49.14		34	Agricultural soil	2009	China, Huainan	67
215		44.00			19.60	14.40	38.00			5	Mining area soil	2007	China, Huainan	68
216		76.80			21.70	32.70	77.10			5	Mining area soil	2007	China, Huainan	68
217		59.80			20.40	27.90	52.20			5	Mining area soil	2007	China, Huainan	68
218										5	Mining area soil	2007	China, Huainan	69
219		71.68			40.29	75.36	128.20	39.71		4	Mining area soil	2004	China, Huainan	70
220		66.22			27.89	56.27	73.61	39.40		9	Mining area soil	2004	China, Huainan	70
221		25.86			19.59	14.39	37.98	23.00		15	Mining area soil	2006	China, Huainan	72

222		92.24		28.49	20.17	69.95	531.00		10	Mining area soil	2006	China, Huainan	72
223		20.17		28.60	35.26	76.29	127.00		25	Mining area soil	2006	China, Huainan	72
224	1.92	25.90		19.60	14.40	38.00	23.00	333.00	5	Mining area soil	2006	China, Huainan	72
225	2.40	45.20		21.70	32.70	77.10	80.00	403.00	5	Mining area soil	2006	China, Huainan	72
226	2.56	35.60		20.40	27.90	52.20	60.40	427.00	5	Mining area soil	2006	China, Huainan	72
227	3.76	35.60		28.70	19.00	61.40	110.00	444.00	5	Mining area soil	2006	China, Huainan	72
228	3.27	26.00		28.30	21.30	78.50	953.00	261.00	5	Mining area soil	2006	China, Huainan	72
229					19.40	94.80			1	Mining area soil	2001	China, Huainan	73
230					29.50	58.00			1	Mining area soil	2001	China, Huainan	73
231	0.90		72.40	70.50		50.00			1	Mining area soil	2001	China, Huainan	73
232	2.60	74.00	196.30	284.00	87.00	116.70			1	Mining area soil	2001	China, Huainan	73
233	3.60	56.50	219.00	482.00	54.90	235.30			1	Mining area soil	2001	China, Huainan	73
234	2.40	84.00	241.00	413.00	66.30	129.00			1	Mining area soil	2001	China, Huainan	73
235	1.80	85.00	44.70	229.70	49.10	127.00			1	Mining area soil	2001	China, Huainan	73
236	2.30	68.00	78.00	345.00	26.50	191.00			1	Mining area soil	2001	China, Huainan	73
237	3.60	72.00	181.40	685.10	84.00	545.50			1	Mining area soil	2002	China, Huainan	74
238	3.05	70.00	146.00	423.60	59.40	380.60			1	Mining area soil	2002	China, Huainan	74
239	1.80	67.00	86.70	245.00	52.80	285.80			1	Mining area soil	2002	China, Huainan	74
240	2.80	78.10	136.10	548.30	38.20	467.00			1	Mining area soil	2002	China, Huainan	74
241	3.90	66.20	145.00	364.90	60.10	296.10			1	Mining area soil	2002	China, Huainan	74
242	0.24	73.00	22.50	58.00	43.50	183.10			1	Mining area soil	2002	China, Huainan	74
243	2.40	66.00	76.50	364.10	25.50	191.00			1	Mining area soil	2002	China, Huainan	74
244	1.60	85.00	43.70	228.70	45.10	121.00			1	Mining area soil	2002	China, Huainan	74
245									4	Mining area soil	2012	China, Huainan	75
246									4	Mining area soil	2012	China, Huainan	75

247										19	Mining area soil	2012	China, Huainan	75
248		89.64	0.02		9.28	18.69	70.59	10.06	362.68	51	Mining area soil	2012	China, Huainan	76
249	0.47	72.73	11.67	18.07	141.00	33.47	0.26	67.30		3	Mining area soil	2017	China, Huainan	77
250	0.08	76.57	0.03	9.96	24.00	26.47	56.57	33.27		3	Mining area soil	2006	China, Huainan	78
251										5	Mining area soil	2009	China, Huainan	79
252		59.15			30.86	32.14	67.88	27.80		6	Mining area soil	2004	China, Huainan	80
253		71.68			40.29	75.36	128.20	39.71		4	Mining area soil	2004	China, Huainan	80
254		66.22			27.89	56.27	73.61	39.40		9	Mining area soil	2004	China, Huainan	80
255		66.15			23.77	34.24	77.65	26.92		5	Mining area soil	2004	China, Huainan	80
256			0.01	11.53				28.98		10	Agricultural soil	2020	China, Huainan	81
257								29.34		113	Agricultural soil	2011	China, Huainan	82
258								30.12		113	Agricultural soil	2011	China, Huainan	82
259										102	Agricultural soil	2011	China, Huainan	82
260	0.43		0.13	6.44	52.93	40.28				30	Agricultural soil	2010	China, Huainan	83
261	0.46		0.11	6.71	53.78	41.83				30	Agricultural soil	2010	China, Huainan	83
262	0.50		0.12	6.33	52.97	42.20				30	Agricultural soil	2010	China, Huainan	83
263	0.45		0.11	6.40	52.58	42.16				30	Agricultural soil	2010	China, Huainan	83
264	0.53		0.13	6.45	58.24	44.21				30	Agricultural soil	2010	China, Huainan	83
265	0.51		0.18	5.86	42.58	43.52				17	Agricultural soil	2010	China, Huainan	83
266	0.57		0.17	6.29	45.94	42.85				17	Agricultural soil	2010	China, Huainan	83
267	0.58		0.18	6.92	43.60	42.22				17	Agricultural soil	2010	China, Huainan	83
268	0.31		0.21	3.82	44.75	32.06				7	Agricultural soil	2010	China, Huainan	83
269	0.32		0.24	3.85	45.17	31.70				7	Agricultural soil	2010	China, Huainan	83
270	0.17		0.24	3.83	47.97	32.31				7	Agricultural soil	2010	China, Huainan	83
271		188.60			50.20	26.40	76.10	34.30		50	Agricultural soil	2017	China, Huainan	84

272	0.17	46.50		35.60	25.80	34.70	42.60			10	Agricultural soil	2014	China, Huainan	85
273	0.13	43.30		23.70	22.40	26.70	37.40			10	Agricultural soil	2014	China, Huainan	85
274	0.10	36.20		16.30	20.60	31.60	47.30	27.67		10	Agricultural soil	2014	China, Huainan	85
275	0.54	85.34		23.42	20.29	64.39	118.02			24	Agricultural soil	2019	China, Huainan	86
276		53.90		8.79	20.90	33.00	82.20		607.00	14	Agricultural soil	2018	China, Huainan	87
277		53.00		6.58	19.90	27.80	111.00		687.00	7	Orchard soil	2018	China, Huainan	87
278		58.30		8.10	22.00	31.90	68.60		641.00	3	Woodland soil	2018	China, Huainan	87
279		60.80		7.68	20.00	30.00	50.70		682.00	2	Agricultural soil	2018	China, Huainan	87
280	0.12	59.62			14.19	21.89	40.03			30	Agricultural soil	2018	China, Huainan	88
281	0.12	59.93			15.61	24.27	43.08			30	Agricultural soil	2018	China, Huainan	88
282	0.11	60.01			13.61	24.18	40.92			30	Agricultural soil	2018	China, Huainan	88
283	0.19	43.52			9.32	20.65	29.37	18.15		15	Agricultural soil	2021	China, Huainan	89
284	0.16	40.48			8.24	19.99	28.81	16.54		15	Agricultural soil	2021	China, Huainan	89
285	0.13	41.46			8.09	20.89	28.04	17.25		15	Agricultural soil	2021	China, Huainan	89
286	0.12	43.78			4.19	21.03	27.65	18.15		15	Agricultural soil	2021	China, Huainan	89
287	0.14	42.60		36.70	26.60	35.10	41.70			8	Mining area soil	2015	China, Huainan	90
288	0.15	44.60		22.20	23.80	30.00	46.50			8	Mining area soil	2015	China, Huainan	90
289	0.13	41.10		17.60	32.70	41.60	67.50			8	Mining area soil	2015	China, Huainan	90
290	1.97	0.34	0.25		0.15	0.05				42	Mining area soil	2013	China, Huainan	91
291	2.18	0.39	0.33		0.14	0.07				42	Mining area soil	2013	China, Huainan	91
292	0.84			12.60	46.30	23.50	85.70	42.60		30	Mining area soil	2016	China, Huainan	92
293	1.26			14.80	38.20	37.60	92.70	41.30		30	Mining area soil	2016	China, Huainan	92
294	1.33			18.30	42.80	43.30	97.40	39.70		30	Mining area soil	2016	China, Huainan	92
295	0.19	49.39	0.21	12.54	24.21	21.74				36	Mining area soil	2016	China, Huainan	93
296		27.00			16.90	14.30	32.10	10.00		25	Mining area soil	2004	China, Huainan	94

297	0.04			8.27						99	Mining area soil	2020	China, Huainan	95
298	0.41	109.39	0.05	18.96		22.72	79.69		655.02	20	Mining area soil	2019	China, Huainan	96
299	1.28				39.80	38.70	90.20			60	Agricultural soil	2017	China, Huainan	97
300	4.80	18.65			25.87					3	Agricultural soil	2020	China, Huainan	98
301										25	Mining area soil	2022	China, Huainan	99
302										6	Mining area soil	2011	China, Huainan	100
303	1.40	213.50	0.04		40.00	38.20	90.20	40.70		9	Agricultural soil	2014	China, Huainan	101
304					26.10					453	Mining area soil	2015	China, Huainan	102
305					25.40					453	Mining area soil	2015	China, Huainan	102
306					20.10					453	Mining area soil	2015	China, Huainan	102

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Tab. S2 Classification of pollution levels in soils

Class	Value	Soil quality
6	$5 \leq I_{geo}$	Extremely contaminated
5	$4 \leq I_{geo} < 5$	Heavily to extremely contaminated
4	$3 \leq I_{geo} < 4$	Heavily contaminated
3	$2 \leq I_{geo} < 3$	Moderately to heavily contaminated
2	$1 \leq I_{geo} < 2$	Moderately contaminated
1	$0 \leq I_{geo} < 1$	Uncontaminated to moderately contaminated
0	$0 \leq I_{geo}$	Uncontaminated

Tab. S3 Grades of the potential ecological risk index

Indices	Low PER (Class 0)	Moderate PER (Class 1)	Considerable PER (Class 2)	Very high PER (Class 3)	Extremely high PER (Class 4)
E_r^n	$E_r^n \leq 40$	$40 < E_r^n \leq 80$	$80 < E_r^n \leq 160$	$160 < E_r^n \leq 320$	$E_r^n > 320$
PERI	PERI ≤ 90	90 < PERI ≤ 180	180 < PERI ≤ 360	360 < PERI ≤ 720	PERI > 720

Note: PER = potential ecological risk

Tab. S4 Exposure indices of human (adult and children) health risk assessment

Indices	Unit	Definition	Adults	Children	References
c	mg/kg	Concentration of PHE of interest in the soil	–	–	This study
lngR	(mg/d)	Soil average daily intake	20	50	(USEPA, 2011)
lnhR	m^3/day	Respiratory rate	16	7.6	(MEPC, 2013)
CF	kg/mg	Conversion coefficient	1×10^{-6}	1×10^{-6}	(USEPA, 2011)
EF	(d/a)	Exposure frequency	350	350	(USEPA, 2011)
ED	(a)	Exposure duration	24	6	(USEPA, 2011)
SA	cm^2	Exposed area through dermal contact	5700	2800	(USEPA, 2011)
AF	mg/cm^2 /d	Adhesion factor of the skin	0.07	0.2	(USEPA, 2011)
ABS	–	Dermal absorption factor	0.03 for As and 0.001 for other PHEs	0.03 for As and 0.001 for other PHEs	(USEPA, 2011)
PEF	m^3/kg	Particle emission factor	1.36×10^9	1.36×10^9	(USEPA, 2011)
BW	kg	Average body weight	60.1	24.5	(USEPA, 2011)
AT_{nc} (Non-carcinogens)	d	Average exposure time	ED × 365	ED × 365	(USEPA, 2011; Chen et al., 2021)
AT_{ca} (Carcinogens)	d	Average exposure time	70 (lifetime) × 365	70 (lifetime) × 365	

Tab. S5 Main exposure parameters of the model.

Parameter	Specific explanation	Probabilistic distribution	Value LN (mean, SD) TRI (minimum, best, maximum)		Reference
			Children	Adults	
IngR	soil ingestion rate (mg/day)	Triangular	TRI (66, 103, 161)	TRI (4, 30, 52)	USEPA, 2011
InhR	air inhalation rate (m^3/day)	Log-normal	LN (7.19, 1.62)	LN (16.57, 4.05)	Chen et al., 2022
EF	exposure frequency (day/year)	Triangular	TRI (180, 345, 365)	TRI (180,345,365)	Smith, 1994
ED	exposure duration (year)	Point	Point (6)	Point (24)	USEPA, 2011
BW	body weight (kg)	Log-normal	LN (37.0, 2.98)	LN (67.55,8.72)	MEP, 2013
AT	average exposure time (day)	Point	Point (2190 for NCR, 25550 for CR)	Point (8760 for NCR, 25550 for CR)	USEPA, 2011
SA	dermal surface area (cm^2/day)	Triangular	TRI (430, 860, 2160)	TRI (760, 1530, 3820)	Liu et al., 2021
AF	soil adherence factor (mg/(cm^2·day))	Log-normal	LN (0.49, 0.54)	LN (0.65, 1.20)	Chen et al., 2022
ABS	dermal fraction absorbed from the soil (unitless)	Point	Point (0.001)	Point (0.001)	USEPA, 2011

PEF	particulate emission factor of heavy metals (m^3/kg)	Point	Point (1.36E+09)	Point (1.36E+09)	USEPA, 2002

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Tab. S6 Values of reference dose (RfD, mg kg^{-1} d^{-1}) and slope factor (SF, mg kg^{-1} d^{-1}) for elements.

Metal elements	RfD			SF			Reference
	Ingest	Inhale	Dermal	Ingest	Inhale	Dermal	
Cd	0.001	0.001	0.00001	6.1	6.3	6.1	MEP., 2013
Cr	0.003	0.0000286	0.003	0.5	42	20	(Liu et al. 2021, Liu et al. 2023)
Hg	0.0003	0.000123	0.000123	−	−	−	MEP., 2013
As	0.0003	0.300	0.000123	1.5	15.1	3.66	USEPA., 2011
Pb	0.0035	0.00352	0.000525	−	−	−	USEPA., 2011
Cu	0.04	0.0402	0.012	1.7	−	42.5	MEP., 2013
Zn	0.300	0.300	0.060	−	−	−	(Liu et al. 2021, Liu et al. 2023)
Ni	0.02	0.00009	0.054	1.7	0.84	42.5	USEPA., 2011
Mn	0.04	0.02	0.14	−	−	−	Zhu et al. 2023

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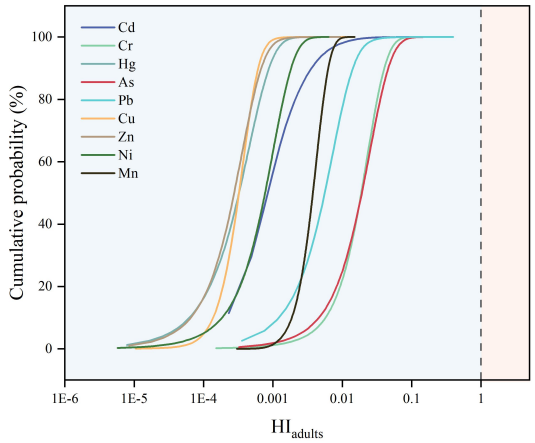

Fig. S1 Probability distribution of noncarcinogenic risks in adults

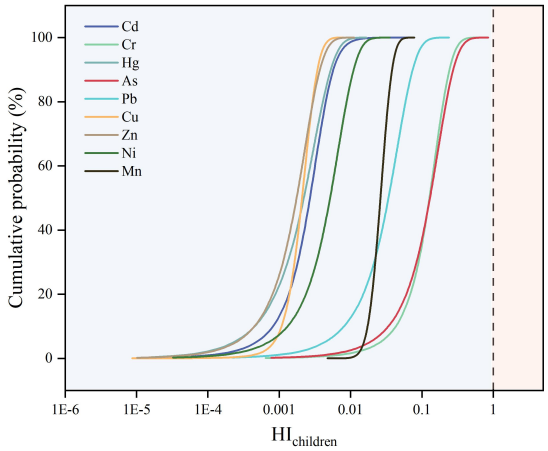

Fig. S2 Probability distribution of noncarcinogenic risks in children

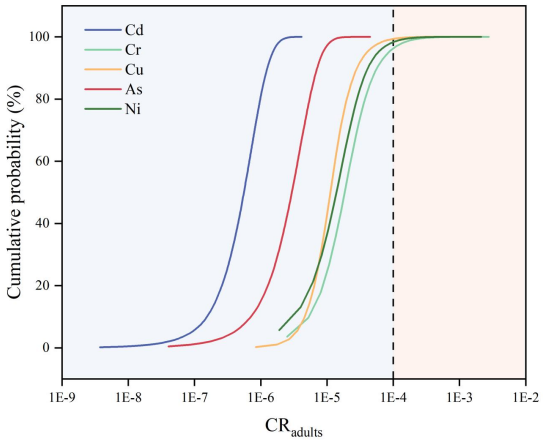

Fig. S3 Probability distribution of carcinogenic risks in adults

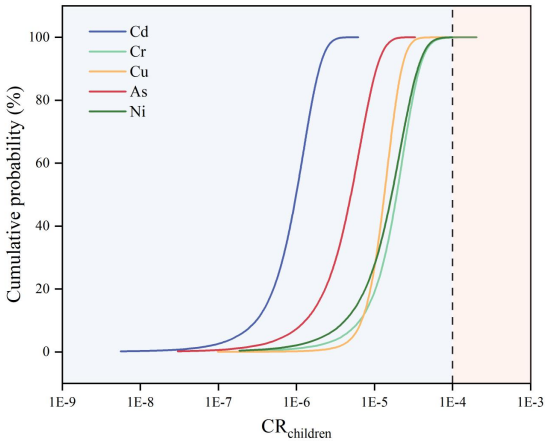

Fig. S4 Probability distribution of carcinogenic risks in children