

1 **Supplementary Information**

2 **Environmental Exposure to Cadmium: Health Risk Assessment and its**  
3 **Associations with Hypertension and Impaired Kidney Function**

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## 21 Supplement to exposure assessment

### 22 A. Dermal exposure

#### 23 1. Soil dermal exposure

$$24 \quad ADI_{\text{der-s}} = \frac{C \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

25 where,  $ADI_{\text{der-s}}$  is the average daily intake through soil dermal exposure (mg/kg-d),  
26 C is the Cd concentration in soil (mg/kg), CF is the convert factor ( $10^{-6}$  kg/mg), SA  
27 is the exposed skin surface area ( $\text{cm}^2$ ), AF is the adherence factor ( $\text{mg}/\text{cm}^2$ ); ABS  
28 is the dermal absorption factor (unitless), EF is the exposure frequency (d/a), ED  
29 is the exposure duration (a), BW is the body weight (kg), and AT is the time period  
30 over which the dose is averaged (d).

#### 31 2. Water dermal exposure

$$32 \quad ADI_{\text{der-w}} = \frac{C \times SA \times PC \times CF \times ET \times EF \times ED}{BW \times AT}$$

33 where,  $ADI_{\text{der-w}}$  is the average daily intake through water dermal exposure (mg/kg-  
34 d), C is the Cd concentration in water (mg/L), SA is the exposed skin surface area  
35 ( $\text{cm}^2$ ), PC is the permeability constant (cm/h), ET is the exposure time (h), CF is  
36 the convert factor ( $1 \text{ L}/1000 \text{ cm}^3$ ), EF is the exposure frequency (d/a), ED is the  
37 exposure duration (a), BW is the body weight (kg), and AT is the time period over  
38 which the dose is averaged (d).

### 39 B. Ingestion exposure

#### 40 1. Soil ingestion exposure

$$41 \quad ADI_{\text{ing-s}} = \frac{C \times IR \times CF \times EF \times ED}{BW \times AT}$$

42 where,  $ADI_{\text{ing-s}}$  is the average daily intake through soil ingestion (mg/kg-d), C is

43 the Cd concentration in soil (mg/kg), IR is the ingestion rate (mg/d), CF is the  
44 convert factor ( $10^{-6}$  kg/mg), EF is the exposure frequency (d/a), ED is the exposure  
45 duration (a), BW is the body weight (kg), and AT is the time period over which the  
46 dose is averaged (d).

47 2. Water ingestion exposure

$$48 \text{ADI}_{\text{ing-w}} = \frac{C \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

49 where,  $\text{ADI}_{\text{ing-w}}$  is the average daily intake through water ingestion (mg/kg-d), C is  
50 the Cd concentration in water (mg/L), IR is the ingestion rate (L/d), EF is the  
51 exposure frequency (d/a), ED is the exposure duration (a), BW is the body weight  
52 (kg), and AT is the time period over which the dose is averaged (d).

53 3. Food ingestion exposure

$$54 \text{ADI}_{\text{ing-f}} = \frac{\sum_{i=1}^n C_i \times \text{IR}_i \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

55 where,  $\text{ADI}_{\text{ing-f}}$  is the average daily intake through food ingestion (mg/kg-d),  $C_i$  is  
56 the Cd concentration in food i (mg/kg),  $\text{IR}_i$  is the ingestion rate of food i (mg/d),  
57 CF is the convert factor ( $10^{-6}$  kg/mg), EF is the exposure frequency (d/a), ED is the  
58 exposure duration (a), BW is the body weight (kg), and AT is the time period over  
59 which the dose is averaged (d).

60 C. Inhalation exposure

$$61 \text{ADI}_{\text{inh}} = \frac{C \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

62 where,  $\text{ADI}_{\text{inh}}$  is the average daily intake through inhalation (mg/kg-d), C is the Cd  
63 concentration in air ( $\text{mg}/\text{m}^3$ ), IR is the inhalation rate ( $\text{m}^3/\text{d}$ ), EF is the exposure  
64 frequency (d/a), ED is the exposure duration (a), BW is the body weight (kg), and

65 AT is the time period over which the dose is averaged (d).

66 D. Cigarette smoking exposure<sup>1,2</sup>

67 
$$ADI_{\text{smoking}} = \frac{[(C_m \times M_m - C_a \times M_a) \times \frac{2}{3} - (C_{fa} \times M_{fa} - C_{fb} \times M_{fb})] \times \frac{1}{2} \times DTC \times EF \times ED}{BR \times BW \times AT}$$

68 where,  $ADI_{\text{smoking}}$  is the average daily intake through smoking ( $\mu\text{g}/\text{m}^3$ ),  $C_m$  is the  
69 Cd concentration in the main body of cigarettes (mg/kg),  $M_m$  is the main body  
70 mass (kg/piece),  $C_a$  is the Cd concentration in the ashes (mg/kg),  $M_a$  is the ash  
71 mass (kg/piece),  $C_{fa}$  is the Cd concentration in the filters after smoking (mg/kg),  
72  $M_{fa}$  is the filter mass after smoking (kg/piece),  $C_{fb}$  is the Cd concentration in the  
73 filters before smoking (mg/kg),  $M_{fb}$  is the filter mass before smoking (kg/piece),  $\frac{2}{3}$   
74 is the rate of smoking, the rest  $\frac{1}{3}$  is spontaneously combusted,  $\frac{1}{2}$  is the absorption  
75 rate of smog, the rest  $\frac{1}{2}$  is exhaled, DTC is the daily cigarette consumption  
76 (piece/d), BR is the daily breathing rate, EF is the exposure frequency (d/a), ED is  
77 the exposure duration (a), BW is the body weight (kg), and AT is the time period  
78 over which the dose is averaged (d).

79 For smoking,  $HQ_{\text{smoking}} = \frac{ADI_{\text{smoking}}}{\text{MRL}}$ , where, MRL is the chronic minimal risk level  
80 ( $1.0\text{E}-02 \mu\text{g}/\text{m}^3$ )<sup>3</sup>.

81 Indigenous exposure factors, including sleep time every day, outdoor time every  
82 day, soil-touching time every day, face wash time every day, bath time every day,  
83 hand-laundering time every day, water intake every day, smoking habits, rice and  
84 vegetables intake every day, were obtained from the questionnaire survey, while  
85 other exposure factors were obtained from Exposure Factors Handbook of Chinese  
86 Population (Adults)<sup>4</sup>.

87 Table S1. Risk assessment parameters.

Parameters	Value	Source
PC <sup>a</sup>	0.001 cm/h	(Canada, 2004) <sup>5</sup>
ABS <sup>b</sup>	0.14	(Canada, 2004) <sup>5</sup>
SA <sup>c</sup>	1.7, 1.7, 1.6, 1.6 cm <sup>2</sup> for males who are 18-44, 45-59, 60-79, ≥80; 1.5, 1.6, 1.5, 1.4 cm <sup>2</sup> for females who are 18-44, 45-59, 60-79, ≥80	(MEP, 2013) <sup>4</sup>
AF <sup>d</sup>	0.0314 mg/cm <sup>2</sup> for face; 0.1336 mg/cm <sup>2</sup> for hand	(USEPA, 2011) <sup>6</sup>
IR <sup>e</sup>	18.4, 18.3, 14.3, 12.4 m <sup>3</sup> /d for males who are 18-44, 45-59, 60-79, ≥80; 14.6, 14.9, 13.3, 11.7 m <sup>3</sup> /d for females who are 18-44, 45-59, 60-79, ≥80	(MEP, 2013) <sup>4</sup>
IR <sub>s</sub> <sup>f</sup>	50 mg/d	(USEPA, 2011) <sup>6</sup>
RfD <sub>oral</sub> <sup>g</sup>	1.0E-03 mg/kg-d	(USEPA, 2004) <sup>7</sup>
RfC <sup>h</sup>	1.0E-05 mg/m <sup>3</sup>	(ATSDR, 2012) <sup>3</sup>
RfD <sub>der</sub> <sup>i</sup>	5.0E-05 mg/kg-d	(USEPA, 2004) <sup>7</sup>
SF <sub>inh</sub> <sup>j</sup>	1.8E-03 m <sup>3</sup> /μg	(USEPA, 1992) <sup>8</sup>
CPF <sup>k</sup>	6.1 kg-d/mg	(YU, 2014) <sup>9</sup>

88 <sup>a</sup> Permeability constant; <sup>b</sup> Dermal absorption factor; <sup>c</sup> Exposed skin surface area;  
 89 <sup>d</sup> Adherence factor; <sup>e</sup> Inhalation rate; <sup>f</sup> Soil ingestion rate; <sup>g</sup> Reference dose for oral  
 90 exposure; <sup>h</sup> Reference concentration in air; <sup>i</sup> Reference dose for oral exposure; <sup>j</sup> Slope  
 91 factor for inhalation; <sup>k</sup> Carcinogenic potency factor.

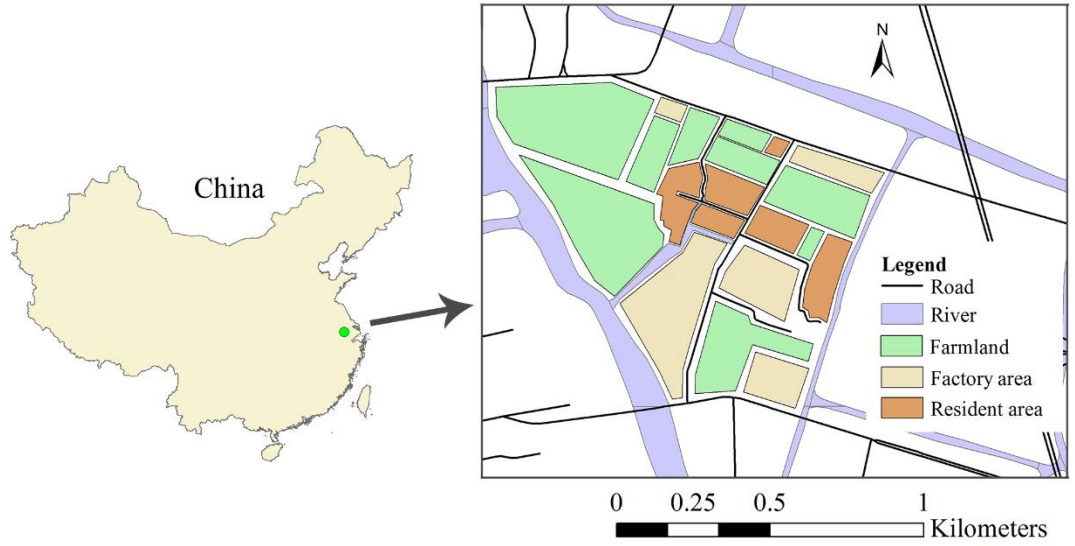
92 Table S2 Indigenous exposure parameters of the study population, by gender.

<b>Items</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>
<b>Daily sleep time (h)</b>	7.2	7.2	7.2
<b>Daily activity time (h)</b>	4.2	2.8	3.3
<b>Soil exposure time (h)</b>	1.9	1.0	1.4
<b>Daily face-washing frequency (times)</b>	2.3	2.4	2.4
<b>Weekly bath frequency (times)</b>	2.0	2.4	2.2
<b>Daily hand-wash clothes time (h)</b>	0.1	0.3	0.2
<b>Daily water intake (ml)</b>	1424	787	1034
<b>Daily rice intake (g/d)</b>	286.8	235	255
<b>Daily vegetable intake (g/d)</b>	444.4	338	379

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95 Figure S1 Location of study area. This sketch map was generated according to its shape  
96 in Baidu Map, using Arcgis 10.1  
97 ([http://downloads.esri.com/support/downloads/other\\_/ArcGIS101sp1-issues.htm](http://downloads.esri.com/support/downloads/other_/ArcGIS101sp1-issues.htm)).  
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