

Regional Inhaled Deposited Dose of Indoor Combustion-Generated Aerosols in Jordanian Urban Homes

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S1. Inhaled Deposited Dose Rate

According to the ICRP and MPPD models, the respiratory tract is divided into three main regions: head/throat, tracheobronchial (TB), and pulmonary/alveolar (P/Alv). Following our previous methods as described by Hussein, et al. [7], we can calculate the regional inhaled deposited dose for a specific particle diameter range (D_{p1} – D_{p2}) during a one-hour exposure period as a dose rate:

$$\text{Dose Rate} = \int_{D_{p1}}^{D_{p2}} V_E \times DF(D_p) \times n_N^0(D_p) \times f \cdot d\log(D_p) \quad (\text{S1})$$

where V_E [m³/h] is the minute ventilation (volume of air breathed, Table S1), $DF(D_p)$ is the particle deposition fraction in a particular region of the respiratory tract (Figure S1), $n_N^0(D_p)$ [particles/cm³] is the particle number size distribution (i.e., $dN/d\log(D_p)$), and f is a metric conversion for the particle concentration (i.e., it is 1 for particle number and for particle mass = $\rho_p D_p^3 \pi / 6$, where ρ_p is the particle effective density). The deposition fraction (DF) and the particle number size distribution (n) are functions of particle diameter (D_p).

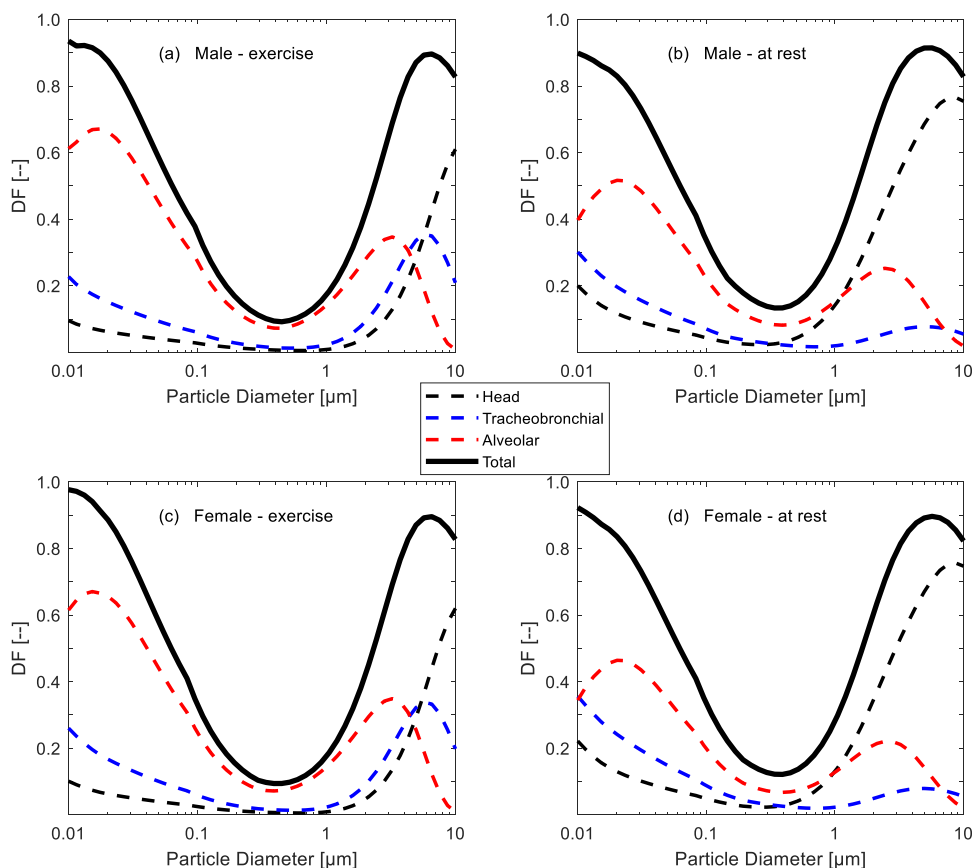


Figure S1. Size-resolved deposition fraction (DF) curves for the respiratory tract of adult subjects: (a) male exercising, (b) male at rest, (c) female exercising, and (d) female at rest. Data was adopted from Löndahl et al. [22] and the ICRP and MPPD models.

The dose rates were calculated for adult male and female subjects reflecting different types of activities (resting, exercising, and conducting house work; Table S1 and Figure S1) and exposure scenarios to different combustion processes (heating, cooking, and smoking). The combination between subjects, activities, and combustion processes reflects common exposure scenarios in Jordanian dwellings during the winter season.

Table S1. Minute ventilation (volume of air breathed), V_E [m^3/h], for adult subjects according to Holmes [21]. The last column indicates the deposition fraction curve used for the listed activity (Figure S1).

Activity	Female	Male	DF Curve Type
Yardwork	1.08	1.74	Exercise
Walking (4.0 km/h)	1.20	1.38	Exercise
Standing	0.48	0.66	at rest
Sitting	0.42	0.54	at rest

S2. Indoor Particle Number Size Distributions

The particle number size distributions were adopted from a previous measurement campaign reported by Hussein et al. [23] for eight homes from 23 December 2018 to 12 January 2019 (i.e. winter season) in Amman, Jordan (Figure S2, Table S2). The experimental setup consisted of two portable condensation particle counters (CPC 3007 and P-Trak 8525, TSI Inc., Minnesota, USA) and a handheld optical particle counter (AeroTrak 9306-V2, TSI Inc., Minnesota, USA); see also Table S3.

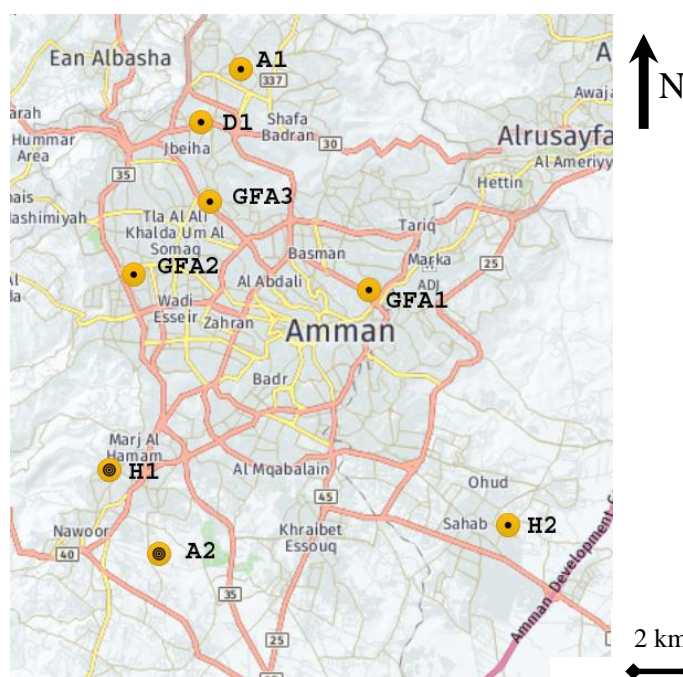


Figure S2. A map showing the Amman metropolitan region with the locations of the selected indoor environment study sites. The type of dwelling is referred to as: (A) Apartment, (H) house, (D) duplex apartment, and (GFA) ground floor apartment. Table S2 provides additional details for each dwelling.

Table S2. Summary of the indoor environments and the measurement campaign period.

Site ID	Heating Method					Smoking		Measurement Period	
	Kerosene	Natural Gas	Air Cond.	Electric	Central	Tobacco	Shisha	Start	End
A1	√	√	√					13:15, 23.12.2018	11:50, 25.12.2018
A2			√					18:20, 04.01.2019	19:50, 05.01.2019
D1	√		√				√	14:10, 28.12.2018	22:10, 30.12.2018
GFA1	√	√						15:10, 25.12.2018	14:10, 27.12.2018
GFA2				√	√			12:00, 09.01.2019	20:40, 12.01.2019
GFA3		√				√	√	12:30, 31.12.2018	18:30, 02.01.2019
H1		√			√		√	20:20, 02.01.2019	16:30, 04.01.2019
H2	√							12:30, 06.01.2019	15:30, 09.01.2019

Table S3. List of the portable air quality instruments and the measured parameters.

Instrument	Model	Aerosol Size Fraction	Metric	Performance Ref.
Optical Particle Counter	TSI AeroTrak 9306-V2	D_p 0.3–25 μm (6 bins)	Number	Wang et al. [24]
Condensation Particle Counter	TSI CPC 3007	D_p 0.01–2 μm	Number	Matson et al. [26]
Condensation Particle Counter	TSI P-Trak 8525	D_p 0.02–2 μm	Number	Matson et al. [26]

S3. Derivation of Particle Size Distributions

The measured concentrations by each instrument were interpolated into a coherent time grid. The use of this combination of portable instruments provides a basis to derive the particle number size distribution (10 nm–25 μm) with 8 channels (0.01, 0.025, 0.3, 0.5, 1, 2.5, 5, 10, and 25 μm) [23–32]. The particle mass size distribution was calculated by assuming spherical particles as:

$$n_M^0 = \frac{dM}{d\log(D_p)} = \frac{dN}{d\log(D_p)} \frac{\pi}{6} D_p^3 \rho_p = n_N^0 \frac{\pi}{6} D_p^3 \rho_p \quad (\text{S2})$$

where n_M^0 is the particle mass size distribution, dM is the particle mass concentration within a certain diameter bin normalized to the width of the diameter range ($d\log(D_p)$) of that diameter bin, dN is the particle number concentration within that diameter bin (also normalized with respect to $d\log(D_p)$) to obtain the particle number size distribution, n_N^0 , D_p is the particle diameter, and ρ_p is the particle effective density (Table S4), here assumed to be similar to what was reported for urban air in Asian cities (Wu and Boor [33]).

Table S4. Urban aerosol effective densities for Asian cities according to a review by Wu and Boor [53].

Range of D_p [μm]	0.01–0.025	0.025–0.3	0.3–0.5	0.5–1	1–2.5	2.5–5	5–10
Effective ρ_p [kg/m^3]	1400	1400	1650	1750	1650	1500	1500

In practice, the particle density is size-dependent and variable for different aerosol populations (i.e., diesel soot vs. organic aerosol); therefore, size-resolved effective density functions should be used. However, there is limited empirical data on the effective densities of aerosols produced by indoor emission sources. Thus, the assumption for the particle effective density will result in uncertainties (over- or under-estimates, depending on the source) in the estimated mass concentrations. As this study is investigating exposure to aerosols originating from fossil fuel combustion (natural gas heaters and stoves, kerosene heaters), we foresee the assumption used here for the effective density as valid for the emission periods.

S4. Mean Particle Number Size Distributions Categorized per Home

Figure S3 presents the mean particle number size distributions during selected indoor activities categorized per home, where they were reported, and compared to the corresponding background particle number size distribution.

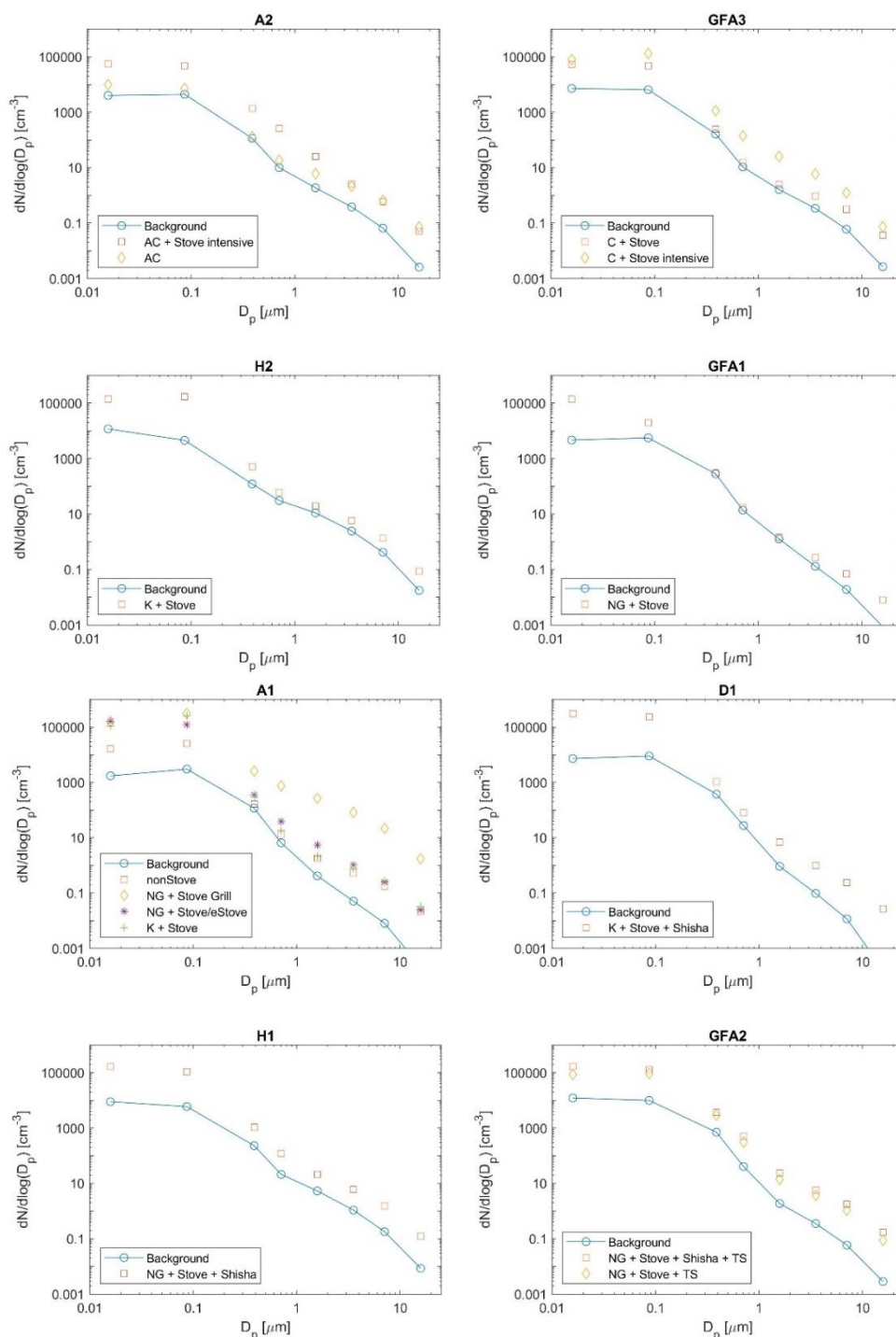


Figure S3. Mean particle number size distributions during selected indoor activities categorized per home, where they were reported, and compared to the corresponding background particle number size distribution. Heating type: natural gas heater (NG), kerosene heater (K), central heating system (C), and air conditioning split unit (AC). Smoking type: shisha (SH) and tobacco smoking (TS). Cooking was reported on either a stove (natural gas) or using non-combustion appliances (e.g. water jug heater, microwave, etc.); the cooking intensity was indicated too.

S5. Calculation of the Size-Fractionated Particle Number and Mass Concentrations

The size-fractionated particle number concentration was calculated as:

$$PN_{D_{p2}-D_{p1}} = \int_{D_{p1}}^{D_{p2}} n_N^0(D_p) \cdot d\log(D_p) \quad (S3)$$

where $PN_{D_{p2}-D_{p1}}$ is the calculated size-fractionated particle number concentration within the particle diameter range $D_{p1}-D_{p2}$. Similarly, the size-fractionated particle mass concentration ($PM_{D_{p2}-D_{p1}}$) was calculated as:

$$PM_{D_{p2}-D_{p1}} = \int_{D_{p1}}^{D_{p2}} n_M^0(D_p) \cdot d\log(D_p) = \int_{D_{p1}}^{D_{p2}} n_N^0(D_p) \frac{\pi}{6} D_p^3 \rho_p \cdot d\log(D_p) \quad (S4)$$

PM_{2.5} and PM₁₀ can be also calculated by using Equation (3) and integrating over the particle diameter range starting from 10 nm (i.e., the lower cutoff diameter according to our instrument setup) and up to 2.5 µm (for PM_{2.5}) or 10 µm (for PM₁₀). Table S5 lists the mean particle concentrations during each selected activity reported in the homes.

Table S5. Classification of indoor activities and corresponding particle concentrations.

Heating ¹	Smoking ²	Cooking ³		Δt [min]	PM _{2.5} [$\mu\text{g}/\text{m}^3$]	PM ₁₀ [$\mu\text{g}/\text{m}^3$]	PN ₁ [$\times 10^3 \text{ cm}^{-3}$]
√ (NG)		--	A1	26	54 ± 26	64 ± 27	214 ± 71
√ (NG)		Stove	A1	59	70 ± 15	81 ± 17	274 ± 38
√ (NG)		Stove / Grilling	A1	27	378 ± 101	2094 ± 882	383 ± 82
√ (NG)		Stove	GFA1	52	9 ± 2	19 ± 3	85 ± 13
√ (NG)		Stove	GFA1	78	13 ± 7	16 ± 7	68 ± 11
√ (NG)	TS	Stove	GFA3	46	40 ± 8	189 ± 57	91 ± 18
√ (NG)	TS	Stove	GFA3	145	98 ± 26	158 ± 51	151 ± 37
√ (NG)	SH	Stove	H1	39	173 ± 41	424 ± 152	245 ± 53
√ (NG)		Stove	GFA1	270	65 ± 17	374 ± 91	169 ± 52
√ (K)		Stove	H2	525	130 ± 15	458 ± 110	318 ± 53
√ (K)		Stove	H2	1064	82 ± 24	154 ± 60	220 ± 78
√ (K)		Stove	H2	979	78 ± 17	141 ± 36	236 ± 52
√ (K)		Stove	H2	324	43 ± 17	91 ± 60	174 ± 62
√ (K)		Stove	A1	84	99 ± 13	119 ± 14	320 ± 45
√ (K)	SH	Stove	D1	631	118 ± 33	139 ± 42	397 ± 60
√ (K)	SH	Stove	D1	750	72 ± 24	92 ± 30	330 ± 46
√ (NG)	SH	Stove	H1	64	139 ± 27	288 ± 114	343 ± 72
√ (NG)	SH	Stove	H1	369	75 ± 18	226 ± 76	198 ± 47
√ (NG)	SH	Stove	H1	520	61 ± 26	168 ± 60	154 ± 39
√ (NG)	SH+TS	Stove	GFA3	123	92 ± 33	189 ± 46	123 ± 34
√ (NG)	SH+TS	Stove	GFA3	221	132 ± 31	291 ± 61	242 ± 77
--		Stove / Soup	A1	38	40 ± 11	76 ± 17	144 ± 40
--		Stove / Chai Latte	A1	34	41 ± 13	49 ± 13	160 ± 44
√ (C)		Stove / intense cooking	GFA2	174	76 ± 41	191 ± 75	116 ± 29
√ (C)		Stove / intense cooking	GFA2	82	85 ± 32	181 ± 56	207 ± 78
√ (C)		Stove / intense cooking	GFA2	348	88 ± 31	201 ± 32	183 ± 91
√ (C)		Stove / Tea	GFA2	43	31 ± 10	52 ± 11	117 ± 43
√ (C)		Stove / Tea + Coffee	GFA2	73	16 ± 4	42 ± 10	46 ± 13
√ (AC)		Stove / intense	A2	194	62 ± 19	112 ± 40	74 ± 28
√ (AC)			A2	189	10 ± 3	61 ± 28	12 ± 4
√ (C)		Microwave	GFA2	19	17 ± 5	44 ± 11	47 ± 17
--		Brewing Coffee	A1	38	7 ± 2	31 ± 21	11 ± 5
--		Brewing Coffee + Toaster	A1	19	14 ± 10	18 ± 11	42 ± 29
--		Toaster	A1	17	15 ± 6	23 ± 7	44 ± 21

⁽¹⁾ Heating type: natural gas heater (NG), kerosene heater (K), central heating system (C), air conditioning split unit (AC), and none (--). ⁽²⁾ Smoking type: shisha (SH) and tobacco smoking (TS). ⁽³⁾ Cooking was reported on either a stove (natural gas) or using non-combustion appliances (e.g. water jug heater, microwave, etc.); the cooking intensity was indicated too.

Table S6. Overall mean background particle number concentrations (ΔN , cm⁻³) in all homes.

ΔDp [μm]	Mean	std	min	5 %	25 %	median	75 %	95 %	max
0.01 – 0.025	3 200	1 600	0	500	2 400	3 100	4 100	5 900	6 900
0.025 – 0.3	6 600	3 300	3 100	3 200	4 300	5 600	8 800	14 800	16 500
0.3 – 0.5	56	44	13	14	25	40	81	154	201
0.5 – 1	6.4	5.5	1.4	1.5	2.4	4.1	8.6	20.4	21.8
1 – 2.5	1.5	2.7	0.2	0.2	0.4	0.5	0.9	10.2	11.0
2.5 – 5	0.2	0.5	0.01	0.01	0.04	0.1	0.1	1.7	1.9
5 – 10	0.0	0.1	0.0001	0.002	0.005	0.010	0.027	0.30	0.33

Table S7. Overall mean particle number concentrations (ΔN , cm⁻³) for TYPE I indoor activities.

ΔDp [μm]	Mean	std	min	5 %	25 %	median	75 %	95 %	max
0.01 – 0.025	4 500	4 800	500	800	1 500	3 100	6 400	9 600	36 700
0.025 – 0.3	11 900	12 300	4 400	5 000	6 300	8 900	10 200	42 600	75 600
0.3 – 0.5	31	9	18	19	25	27	39	46	51
0.5 – 1	5.3	1.8	3.1	3.3	4.0	4.3	7.2	8.3	9.5
1 – 2.5	2.1	1.1	0.4	0.6	1.4	1.7	3.2	3.8	4.9
2.5 – 5	0.5	0.3	0.1	0.1	0.3	0.5	0.8	1.1	1.8
5 – 10	0.2	0.1	0.01	0.02	0.1	0.1	0.2	0.4	0.6

Table S8. Overall mean particle number concentrations (ΔN , cm⁻³) for TYPE II indoor activities.

ΔDp [μm]	Mean	std	min	5 %	25 %	median	75 %	95 %	max
0.01 – 0.025	29 000	21 700	400	7 700	15 200	24 200	36 000	67 200	159 300
0.025 – 0.3	115 100	75 600	11 600	32 400	56 300	87 700	156 300	255 000	304 100
0.3 – 0.5	300	100	38	100	200	200	300	500	600
0.5 – 1	53	32	9	23	31	45	58	126	156
1 – 2.5	10.2	4.4	4.6	5.6	7.5	9.2	11.3	18.3	30.8
2.5 – 5	1.5	0.6	0.5	0.5	1.0	1.5	1.8	2.5	3.5
5 – 10	0.3	0.1	0.08	0.11	0.2	0.3	0.4	0.5	0.7

Table S9. Overall mean particle number concentrations (ΔN , cm⁻³) for TYPE III indoor activities.

ΔDp [μm]	Mean	std	min	5 %	25 %	median	75 %	95 %	max
0.01 – 0.025	130 400	114 200	100	14 900	49 400	107 600	169 700	348 500	795 400
0.025 – 0.3	158 300	75 100	1 600	17 700	102 100	173 700	220 300	257 600	294 900
0.3 – 0.5	400	400	0	100	200	300	500	1 200	2 200
0.5 – 1	52	46	4	7	23	34	66	145	351
1 – 2.5	16.0	18.4	0.5	1.2	4.2	8.4	19.5	58.8	109.4
2.5 – 5	4.8	6.0	0.1	0.2	1.1	2.4	5.8	19.4	28.5
5 – 10	1.1	1.3	0.01	0.04	0.3	0.6	1.2	4.4	6.7

Table S10. Overall mean particle number concentrations (ΔN , cm⁻³) for TYPE IV indoor activities.

ΔDp [μm]	Mean	std	min	5 %	25 %	median	75 %	95 %	max
0.01 – 0.025	212 500	150 700	800	39 500	90 000	182 200	306 300	449 900	901 000
0.025 – 0.3	157 000	79 800	8 200	48 000	94 200	135 600	223 100	300 600	334 900
0.3 – 0.5	1 600	1 500	100	100	400	800	3 000	4 400	5 200
0.5 – 1	179	219	12	16	38	72	250	669	1 126
1 – 2.5	15.7	15.0	1.7	2.3	5.3	14.0	20.3	40.8	349.4
2.5 – 5	3.9	3.2	0.3	0.5	1.1	3.8	5.6	9.8	27.8
5 – 10	1.1	0.9	0.05	0.11	0.3	1.0	1.5	2.7	7.9

S6. Dose Rate Calculations Based on the Median Particle Number Size Distributions

Table S11. Median regional dose rates for adult exposure during indoor background conditions. Note that yardwork is assumed to be equivalent to housework and running is equivalent to indoor exercising.

		Males				Females			
		Head	TB	Alv	Total	Head	TB	Alv	Total
PN ₁ [×10 ⁶ #/hour]	Yardwork	700	1600	6700	8900	400	1100	4000	5500
	Running 8.0 km/h	1400	3200	13300	17800	1200	3000	11300	15500
	Walking 4.0 km/h	500	1300	5300	7100	500	1200	4500	6100
	Standing	500	800	3400	3200	400	700	1300	2400
	Sitting	400	600	2800	2600	300	600	1100	2100
PM _{2.5} [µg/hour]	Yardwork	0.3	0.6	2.7	3.5	0.2	0.4	1.6	2.1
	Running 8.0 km/h	0.5	1.2	5.3	7.0	0.5	1.0	4.5	6.0
	Walking 4.0 km/h	0.2	0.5	2.1	2.8	0.2	0.4	1.8	2.4
	Standing	0.5	0.2	1.3	1.7	0.4	0.2	0.6	1.2
	Sitting	0.4	0.2	1.1	1.4	0.3	0.2	0.5	1.0
PM ₁₀ [µg/hour]	Yardwork	3.1	3.1	4.4	10.6	2.0	1.9	2.7	6.6
	Running 8.0 km/h	6.2	6.2	8.8	21.3	5.6	5.3	7.6	18.5
	Walking 4.0 km/h	2.5	2.5	3.5	8.4	2.2	2.1	3.0	7.3
	Standing	2.8	0.5	4.0	4.6	2.0	0.4	0.9	3.2
	Sitting	2.3	0.4	3.3	3.8	1.7	0.3	0.8	2.8

Table S12. Median regional dose rate for adults exposure during TYPE I indoor activities. Note that yardwork is assumed to be equivalent to housework and running is equivalent to indoor exercising.

		Males				Females			
		Head	TB	Alv	Total	Head	TB	Alv	Total
PN ₁ [×10 ⁶ #/hour]	Yardwork	800	1900	8400	11200	500	1300	5000	6900
	Running 8.0 km/h	1700	3900	16700	22300	1500	3700	14100	19200
	Walking 4.0 km/h	700	1500	6600	8800	600	1400	5600	7600
	Standing	600	900	4200	4100	500	800	1700	3000
	Sitting	500	800	3400	3300	400	700	1400	2600
PM _{2.5} [μg/hour]	Yardwork	0.5	1.1	5.0	6.7	0.3	0.7	3.1	4.1
	Running 8.0 km/h	1.0	2.3	10.1	13.4	0.9	2.0	8.6	11.6
	Walking 4.0 km/h	0.4	0.9	4.0	5.3	0.4	0.8	3.4	4.6
	Standing	1.3	0.4	2.5	3.5	0.9	0.3	1.1	2.4
	Sitting	1.1	0.3	2.1	2.8	0.8	0.3	1.0	2.1
PM ₁₀ [μg/hour]	Yardwork	37.0	30.9	20.7	88.5	23.7	18.3	12.9	54.9
	Running 8.0 km/h	73.9	61.8	41.3	177.0	66.5	51.5	36.2	154.1
	Walking 4.0 km/h	29.3	24.5	16.4	70.2	26.3	20.4	14.3	61.0
	Standing	27.2	3.0	33.6	36.1	19.4	2.3	3.9	25.6
	Sitting	22.2	2.5	27.5	29.5	17.0	2.0	3.5	22.4

Table S13. Median regional dose rate for adults exposure during TYPE II indoor activities. Note that yardwork is assumed to be equivalent to housework and running is equivalent to indoor exercising.

		Males				Females			
		Head	TB	Alv	Total	Head	TB	Alv	Total
PN ₁ [×10 ⁶ #/hour]	Yardwork	7600	17300	75500	100400	4600	11600	45300	61500
	Running 8.0 km/h	15200	34700	150900	200800	13000	32500	127200	172600
	Walking 4.0 km/h	6000	13700	59900	79600	5100	12900	50400	68400
	Standing	5100	8300	37600	36500	4100	7500	15000	26600
	Sitting	4200	6800	30800	29900	3600	6600	13100	23300
PM _{2.5} [μg/hour]	Yardwork	3.9	8.6	39.1	51.6	2.4	5.5	23.7	31.6
	Running 8.0 km/h	7.8	17.3	78.2	103.2	6.7	15.5	66.4	88.6
	Walking 4.0 km/h	3.1	6.8	31.0	40.9	2.7	6.1	26.3	35.1
	Standing	8.1	3.3	19.3	24.9	5.7	2.9	8.6	17.2
	Sitting	6.6	2.7	15.8	20.4	5.0	2.6	7.5	15.1
PM ₁₀ [μg/hour]	Yardwork	94.1	85.4	85.2	264.7	60.3	51.0	52.6	163.9
	Running 8.0 km/h	188.2	170.7	170.5	529.4	169.1	143.2	147.6	459.9
	Walking 4.0 km/h	74.6	67.7	67.6	209.9	67.0	56.7	58.4	182.1
	Standing	75.2	10.2	100.2	110.9	53.5	8.1	16.8	78.3
	Sitting	61.5	8.4	82.0	90.8	46.8	7.1	14.7	68.5

Table S14. Median regional dose rate for adults exposure during TYPE III indoor activities. Note that yardwork is assumed to be equivalent to housework and running is equivalent to indoor exercising.

		Males				Females			
		Head	TB	Alv	Total	Head	TB	Alv	Total
PN ₁ [×10 ⁶ #/hour]	Yardwork	22400	52200	219100	293600	13800	35400	133000	182100
	Running 8.0 km/h	44700	104300	438100	587100	38800	99200	373000	511000
	Walking 4.0 km/h	17700	41400	173700	232800	15400	39300	147700	202400
	Standing	15500	25400	111300	106200	12600	22700	42400	77700
	Sitting	12700	20800	91100	86900	11000	19900	37100	68000
PM _{2.5} [µg/hour]	Yardwork	6.0	13.2	60.2	79.4	3.6	8.5	36.1	48.1
	Running 8.0 km/h	12.0	26.3	120.5	158.7	10.2	23.7	101.2	135.0
	Walking 4.0 km/h	4.7	10.4	47.8	63.0	4.0	9.4	40.1	53.5
	Standing	8.9	5.5	29.4	34.6	6.4	4.9	12.9	24.3
	Sitting	7.3	4.5	24.1	28.3	5.6	4.3	11.3	21.2
PM ₁₀ [µg/hour]	Yardwork	172.0	151.6	138.5	462.1	110.1	90.5	85.2	285.8
	Running 8.0 km/h	343.9	303.2	277.1	924.2	308.9	254.0	239.0	801.9
	Walking 4.0 km/h	136.4	120.2	109.9	366.5	122.3	100.6	94.7	317.6
	Standing	129.6	17.8	174.7	188.2	92.5	14.1	27.0	133.6
	Sitting	106.0	14.6	142.9	154.0	80.9	12.4	23.6	116.9

Table S15. Median regional dose rate for adults exposure during TYPE IV indoor activities. Note that yardwork is assumed to be equivalent to housework and running is equivalent to indoor exercising.

		Males				Females			
		Head	TB	Alv	Total	Head	TB	Alv	Total
PN ₁ [×10 ⁶ #/hour]	Yardwork	29500	70000	285500	385000	18500	48000	174900	241400
	Running 8.0 km/h	59000	140100	571000	770100	51900	134700	490600	677200
	Walking 4.0 km/h	23400	55500	226400	305400	20600	53300	194300	268200
	Standing	21000	34500	147500	138500	17000	30700	53900	101600
	Sitting	17200	28200	120700	113300	14900	26800	47200	88900
PM _{2.5} [µg/hour]	Yardwork	6.3	13.9	63.2	83.4	3.9	8.9	38.3	51.1
	Running 8.0 km/h	12.6	27.8	126.5	166.8	10.9	25.0	107.4	143.3
	Walking 4.0 km/h	5.0	11.0	50.2	66.2	4.3	9.9	42.5	56.7
	Standing	12.9	5.5	31.2	40.3	9.1	4.8	13.9	27.8
	Sitting	10.5	4.5	25.5	33.0	7.9	4.2	12.2	24.3
PM ₁₀ [µg/hour]	Yardwork	258.1	225.0	184.7	667.8	165.4	134.1	114.5	414.0
	Running 8.0 km/h	516.2	450.0	369.3	1335.6	464.1	376.2	321.2	1161.5
	Walking 4.0 km/h	204.7	178.5	146.5	529.6	183.8	149.0	127.2	460.0
	Standing	197.0	24.3	253.0	275.3	140.4	18.9	35.6	194.9
	Sitting	161.2	19.9	207.0	225.2	122.8	16.5	31.2	170.5

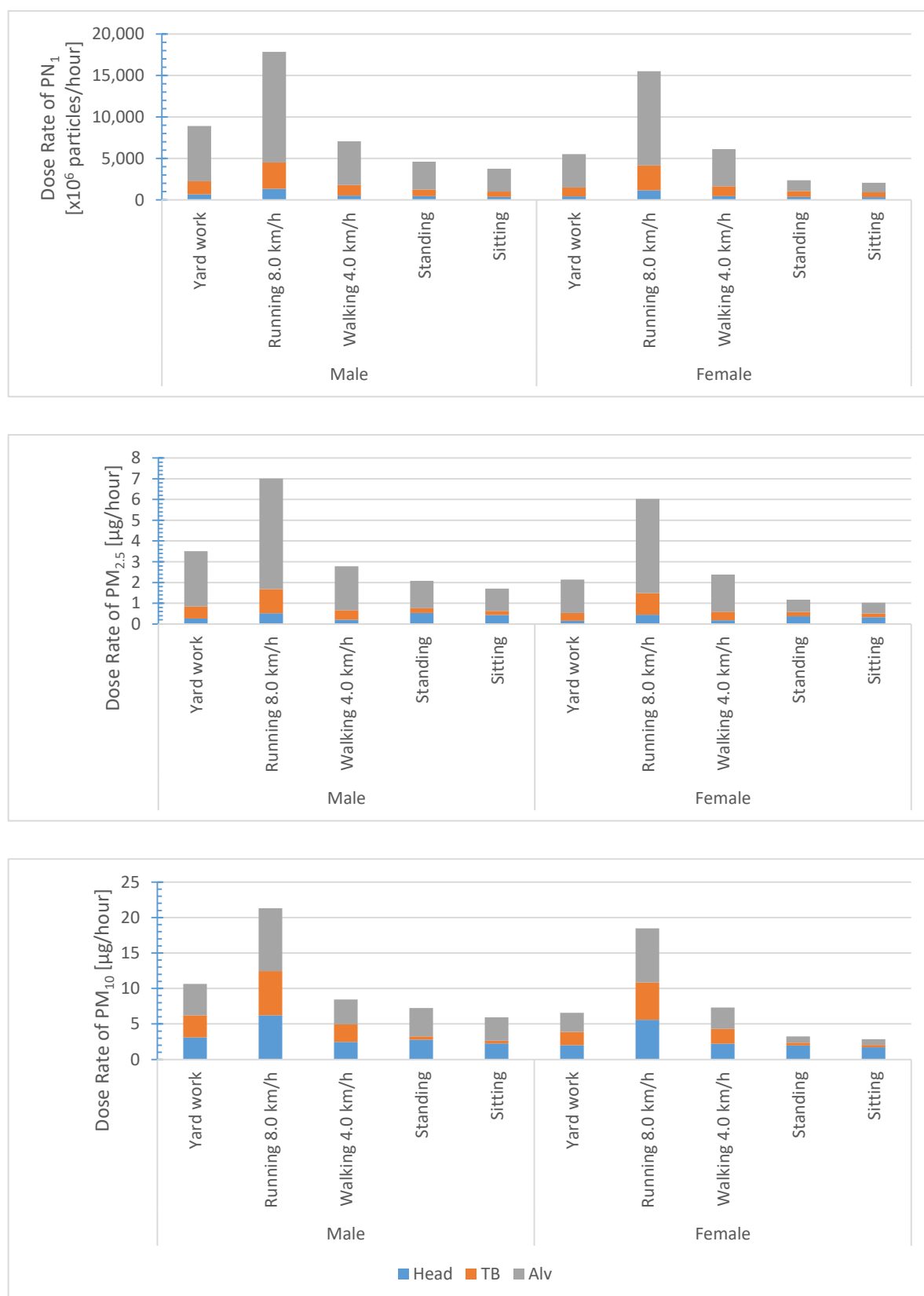


Figure S4. The indoor background conditions; regional inhaled deposited dose rates calculated for different activities (exposure based on median concentrations) and adults: (**upper**) number of submicron particles and (**middle, lower**) particulate matter PM_{2.5} and PM₁₀. The color legend is: (blue) head airways, (red) tracheobronchial, and (gray) alveolar. Note that “yard work” is equivalent to “house work” activities and “running” is equivalent to “exercising (e.g. treadmill)”.

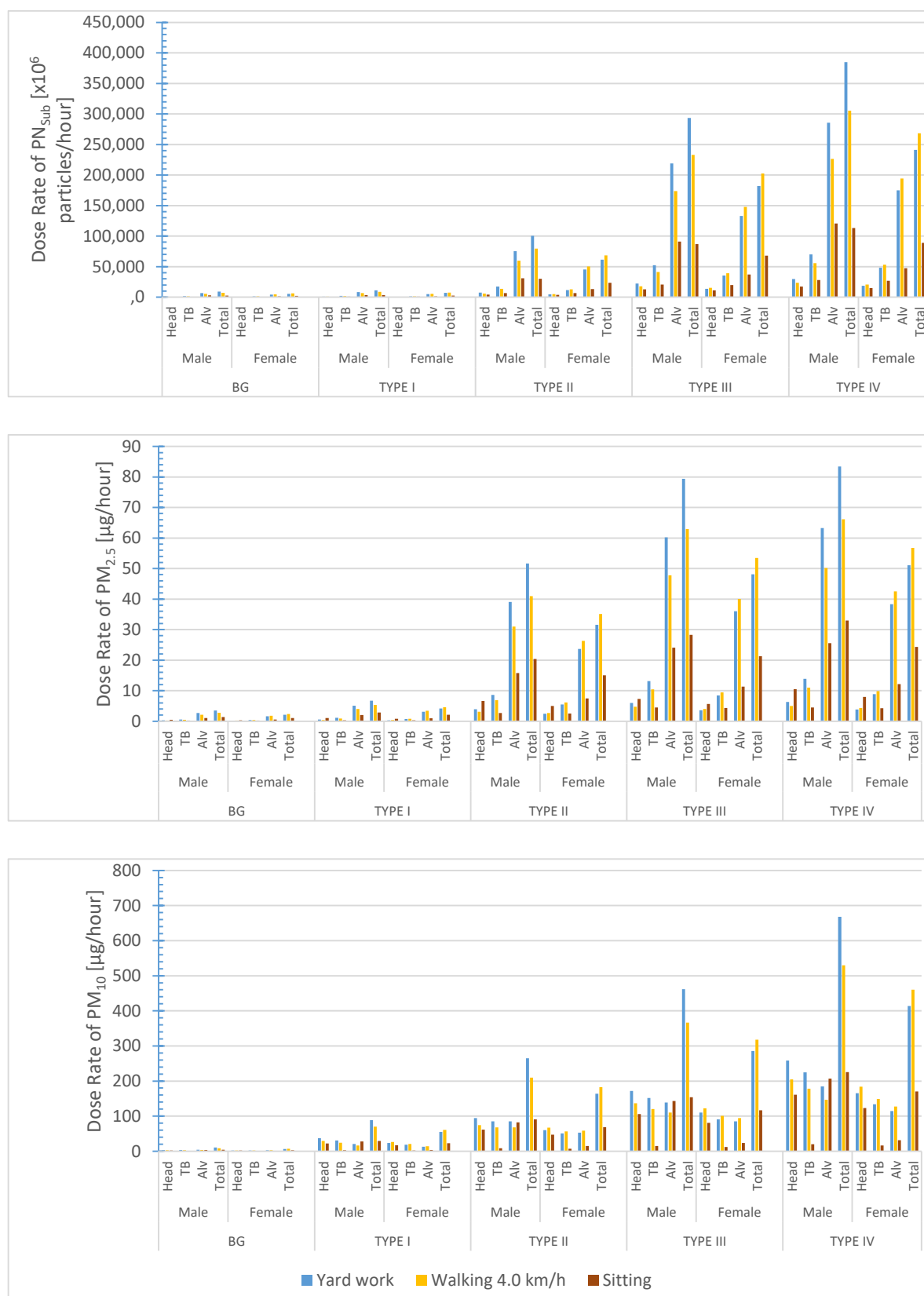


Figure S5. The categorized indoor activities and background conditions; regional inhaled deposited dose rates calculated (exposure based on median concentrations) for different activities and adults: (**upper**) number of submicron particles and (**middle, lower**) particulate matter $PM_{2.5}$ and PM_{10} . The color legend is: (blue) yard work equivalent activities, (yellow) walking activities, and (red) sitting and resting.

References

All citations appeared in this supplementary material are found in the references list in the main text of the manuscript.