Supplementary Materials

Table S1. Summary of sampling locations, the numbers of samples, and traffic volumes of the sites.

Sampling site	The number of samples	Location (GPS)	Traffic volume (vehicles/day)[1)]	Land use category
T1	12[2)]	36.353590, 127.341481	16,229	Main traffic roads (T)
T2	12	36.366968, 127.317705	14,049	
T3	12	36.362348, 127.344778	16,852	
T4	12	36.357928, 127.380131	12,876	
R1	12	36.379016, 127.319469	NA	Roads in residential area (R)
R2	12	36.391967, 127.309573		
R3	12	36.358965, 127.366570		
R4	12	36.350293, 127.391844		
R5	12	36.425055, 127.385877		
R6	12	36.430038, 127.383817		
I1	12	36.440987, 127.400724		Roads in industrial area (I)
I2	12	36.434218, 127.401542		
Total	144			

NA: Not Available

Traffic volumes obtained from Traffic Data Warehouse System (http://tportal.daejeon.go.kr) [41].

Three RDS samples were collected per season at each site.

Table S2. Summary of four PAHs recovery test for ambient sample

Standard material	Number of samples	Recovery test (%)	Average ±Standard deviation
Naphthalene-d8	5	68.7, 63.4, 63.2, 82.1, 74.7	70.4±8.1
Phenanthrene-d10	5	80.6, 108.0, 65.7, 63.4, 68.0	77.1±18.5
Pyrene-d10	5	74.7, 89.1, 72.1, 63.9, 66.5	73.3±9.9
Benzo(a)pyrene-d12	5	72.8, 100.0, 71.2, 63.2, 66.9	74.9±14.6

Text S1. Procedure for determining of method detection limits for PAHs in RDS

All data were subject to strict quality control procedures. Quantification was done using an internal calibration method. Seven replicates of control sediment sample spiked with a mixture of target compounds at concentration ranges of 1-50 μg/kg each were processed through the entire extraction and clean-up procedure. The method detection limit (MDL) and the lower limit of quantification (LOQ) were calculated at a Student's t-value of 3.143 (99% confidence level for seven replicates) and 10 times the standard deviation of 7 replicate measurements, according to the EPA Regulation [1]. The MDLs determined in this study ranged from 0.01 to 0.2 μg/kg.

Table S3. Summary of detection limit of GC/MS for PAHs in RDS

Compound	Detection limits (ug/kg)		Spiked concentration (ug/kg)	Detected concentration (Mean ±Standard deviation) (ug/kg)
	MDL	LOQ		
1. Naphthalene	0.20	0.60	1.00	1.12±0.08
			5.00	5.12±0.26
2. Acenaphthylene	0.02	0.06	1.00	1.01±0.09
			5.00	4.86±0.17
3. Acenaphthene	0.02	0.06	1.00	1.07±0.12
			5.00	5.17±0.10
4. Fluorene	0.04	0.12	1.00	1.04±0.11
			5.00	4.92±0.16
5. Phenanthrene	0.02	0.06	5.00	5.07±0.07
			50.0	49.40±1.75
6. Anthracene	0.03	0.09	1.00	1.13±0.08
			5.00	5.26±0.18
7. Fluoranthene	0.03	0.10	5.00	5.15±0.06
			50.0	50.67±3.45
8. Pyrene	0.04	0.12	5.00	4.88±0.09
			50.0	48.78±1.77
9. Benzo(a)anthracene	0.01	0.03	1.00	0.91±0.07
			5.00	4.66±0.27
10. Benzo(b)fluoranthene	0.02	0.06	1.00	1.08±0.13
			5.00	5.09±0.15
11. Benzo(k)fluoranthene	0.02	0.06	1.00	1.11±0.09
			5.00	5.05±0.18
12. Benzo(a)pyrene	0.01	0.03	1.00	1.06±0.11
			5.00	5.15±0.06
13. Dibenz(a,h)anthracene	0.01	0.03	1.00	1.10±0.13
			5.00	5.11±0.06
14. Chrysene	0.02	0.06	1.00	0.99±0.12
			5.00	5.01±0.26
15. Benzo(g,h,i)perylene	0.04	0.12	1.00	1.08±0.11
			5.00	5.08±0.14
16. Indeno(1,2,3-cd)pyrene	0.02	0.06	1.00	0.88±0.08
			5.00	4.77±0.10

Table S4. Exposure factors applied in this study

Exposure Factors	Unit	Value		References
		Adult	Child	
EF	day/year	365		-
AT	year	82.7		[48]
PEF	m^3/kg	1.36E+09		[33]
ABS	unitless	0.13		[44]
AF	mg/cm^2	0.2		[46]
ED	year	7.7		[50]
ET	hr/day	2.18	0.69	[48, 49]
BW	kg	64.5	20.8	[48, 49]
IRa	m^3/hr	0.61	0.53	[48, 49]
IRs	mg/day	50	100	[47]
SA	cm^2/event(day)	4706	2800	[48, 49]

Table S5. The climate characteristics of sampling sites (DMC in South Korea)

Based on 2019-2020	Average temperature (℃)	Rainfall (mm/month)	Average humidity (%)	Wind speed (m/s)
Autumn (November)	8.7	94	72	6.1
Winter (February)	3.6	91.2	68	5.9
Spring (May)	18.8	80.4	72	7.8
Summer (August)	27.5	361.6	87	8.1

South Korea has a temperate climate with four distinct seasons. It is located at 38° latitude affected by monsoons. The weather is cold and dry in winter and warm and humid in summer. Most of the rainfall is concentrated in summer. [41].

Table S6. The seasonal average concentration of 16 PAHs from RDS in DMC by land use type

Season	Land use type	Average concentration of 16 PAHs (μg/kg)
Autumn (Nov., 2019)	Residential	275.82 (n=18)
	Traffic	703.99 (n=12)
	Industrial	1408.01 (n=6)
Winter (Feb., 2020)	Residential	451.61 (n=18)
	Traffic	1145.79 (n=12)
	Industrial	3347.92 (n=6)
Spring (May, 2020)	Residential	210.31 (n=18)
	Traffic	553.31 (n=12)
	Industrial	1626.02 (n=6)
Summer (Jul., 2020)	Residential	181.75 (n=18)
	Traffic	196.90 (n=12)
	Industrial	643.46 (n=6)

Table S7. Summary of statistical analysis for the PAHs concentrations by season

Season	Number of sites	Sum	Average	Variance	F-value	P-value	F critical value
Autumn (Nov., 2019)	6	5347.9	891.3	343952.9	3.40176	0.03773	3.09839
Winter (Feb., 2020)	6	11831.3	1791.9	2419289.0			
Spring (May, 2020)	6	5374.7	895.8	426334.7			
Summer (Jul., 2020)	6	2049.4	341.6	98685.8			

At significance level: 5%

Table S8. Hazard Index of 16 PAHs from RDS in DMC

Sampling site	HI for Adult	HI for Child
R1	2.34E-06	4.73E-07
R2	1.80E-06	3.63E-07
R3	4.30E-06	8.69E-07
R4	2.86E-06	5.77E-07
R5	4.55E-06	9.19E-07
R6	4.97E-06	1.01E-06
T1	1.37E-05	2.76E-06
T2	1.23E-05	2.50E-06
T3	3.81E-06	7.70E-07
T4	5.37E-06	1.09E-06
I1	2.73E-05	5.51E-06
I2	1.87E-05	3.78E-06

Table S9. Excess cancer risks of 16 PAHs from RDS in DMC

Sampling site	Inhalation		Dermal contact		Ingestion		Total ECR	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child
R1	7.06E-14	9.51E-14	4.81E-09	5.21E-09	6.22E-10	1.35E-09	5.83E-09	6.16E-09
R2	5.59E-14	7.53E-14	3.81E-09	4.13E-09	4.92E-10	1.07E-09	4.62E-09	4.88E-09
R3	1.29E-13	1.74E-13	8.8E-09	9.54E-09	1.14E-09	2.47E-09	1.07E-08	1.13E-08
R4	8.62E-14	1.16E-13	5.87E-09	6.36E-09	7.59E-10	1.65E-09	7.12E-09	7.52E-09
R5	1.28E-13	1.72E-13	8.71E-09	9.44E-09	1.13E-09	2.44E-09	1.06E-08	1.12E-08
R6	1.41E-13	1.90E-13	9.59E-09	1.04E-08	1.24E-09	2.69E-09	1.16E-08	1.23E-08
T1	3.67E-13	4.95E-13	2.5E-08	2.71E-08	3.23E-09	7.02E-09	3.03E-08	3.20E-08
T2	3.16E-13	4.26E-13	2.15E-08	2.33E-08	2.79E-09	6.05E-09	2.61E-08	2.76E-08
T3	1.06E-13	1.43E-13	7.21E-09	7.82E-09	9.33E-10	2.03E-09	8.75E-09	9.24E-09
T4	1.54E-13	2.07E-13	1.05E-08	1.14E-08	1.36E-09	2.94E-09	1.27E-08	1.34E-08
I1	7.65E-13	1.03E-12	5.21E-08	5.64E-08	6.73E-09	1.46E-08	6.32E-08	6.67E-08
I2	4.96E-13	6.69E-13	3.38E-08	3.66E-08	4.37E-09	9.49E-09	4.1E-08	4.33E-08

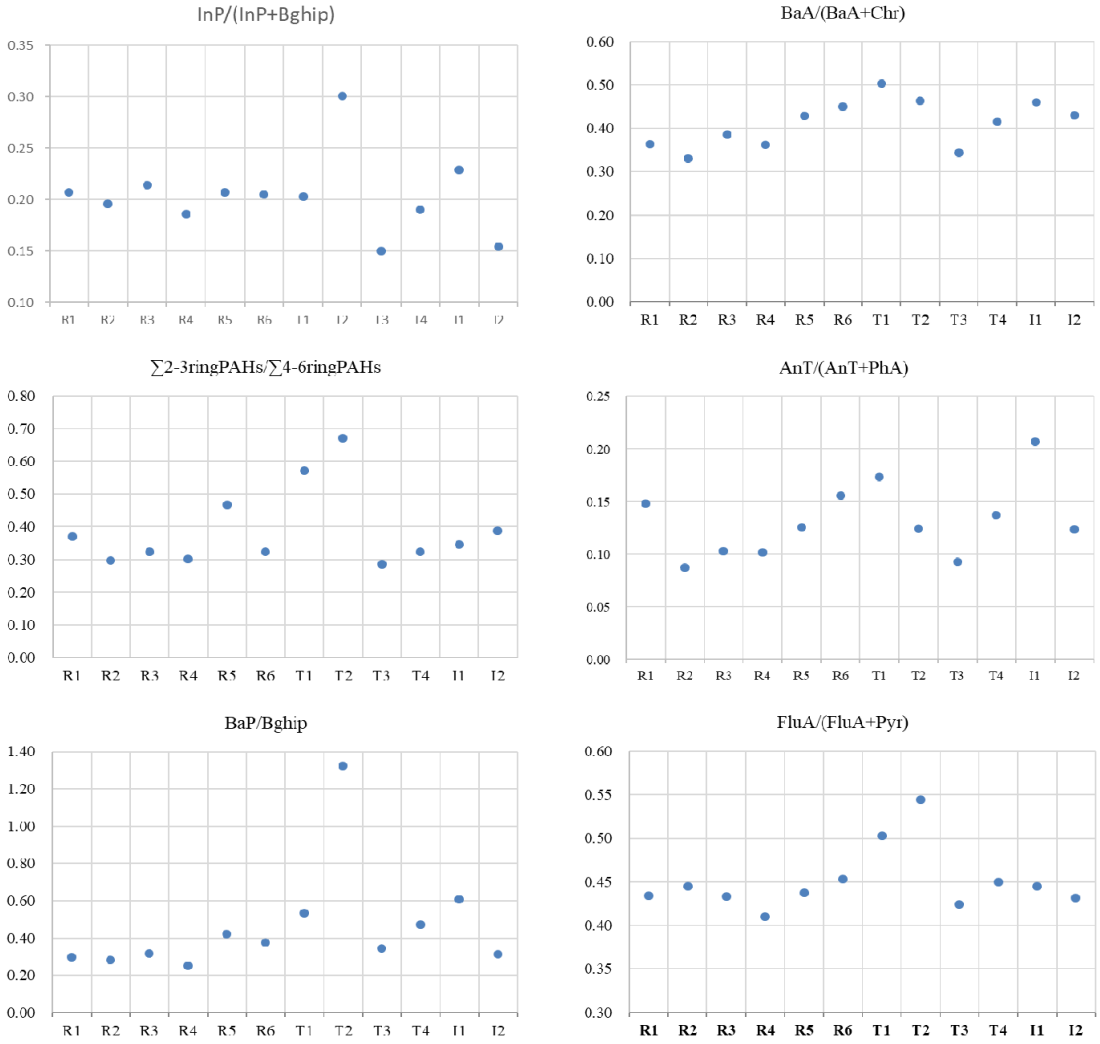

Fig. S1. Diagnostic ratios of PAHs from RDS in DMC

References

1. U.S. EPA (U.S. Environmental Protection Agency). Definition and Procedure for the Determination of the Method Detection Limit, Revision 2; EPA 821-R-16-006. Washington, DC: Office of Water; 2016.