

Supplementary material for
Life Cycle Risk Assessment Applied to Gaseous Emissions from Crumb
Rubber Asphalt Pavement Construction

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Table S1. Coefficients used to calculate the characterization factors (CF) for the human toxicity for the PAHs.

	ED ₅₀ (RfD)	ED ₅₀ (SF)	EF (RfD)	EF (SF)	FF	XF	CF (RfD)	CF (SF)
PAHs								
Standard								
Benzo[b]fluoranthene		0.909		0.550	0.048	7,200.000		189.874
Benzo[a]pyrene		0.091		5.500	0.045	7,200.000		1,768.111
Naphtalene	0.003	2.941	148.148	0.170	0.050	7,200.000	53,312.092	61.176
Othres	0.056		8.880		0.047	7,200.000	2,998.679	
CR Gap graded								
Pyrene	0.003		148.148		0.045	7,200.000	48,268.114	
Benz[a]anthracene	0.000	0.909		0.550	0.045	7,200.000		178.211
Benzo[b]fluoranthene	0.000	0.909		0.550	0.049	7,200.000		193.856
Benzo[ghi]perylene	0.003		148.148		0.041	7,200.000	43,815.718	
Naphtalene	0.003	2.941	148.148	0.170	0.050	7,200.000	53,312.092	61.176
Others	0.056		8.880		0.046	7,200.000	2,942.179	
CR Dense graded								
Benzo[b]fluoranthene		0.909		0.550	0.048	7,200.000		189.874
Naphtalene	0.003	2.941	148.148	0.170	0.050	7,200.000	53,312.092	61.176
Others	0.056		8.880		0.046	7,200.000	2,920.964	

Table S2. Coefficients used to calculate the characterization factors (CF) for the human toxicity for the VOCs.

	ED ₅₀ (RfD)	ED ₅₀ (SF)	EF (RfD)	EF (SF)	FF	XF	CF (RfD)	CF (SF)
VOCs								
Standard								
Benzene	0.034	12.821	14.815	0.039	0.054	7,200.000	5,715.073	15.045
Toluene	5.625		0.089		0.053	7,200.000	33.730	
ethylbenzene	1.125	40.000	0.444	0.013	0.052	7,200.000	167.992	4.725
p-Xylene	0.113		4.444		0.051	7,200.000	1,639.633	
Others	1.122		0.446		0.050	7,200.000	160.470	
CR Gap graded								
Benzene	0.034	12.821	14.815	0.039	0.054	7,200.000	5,715.073	15.045
Toluene	5.625		0.089		0.053	7,200.000	33.730	
ethylbenzene	1.125	40.000	0.444	0.013	0.052	7,200.000	167.992	4.725
p-Xylene	0.113		4.444		0.051	7,200.000	1,639.633	
Styrene		1.225		0.408	0.045	7,200.000		131.477
Benzene, 1,2,4-trichloro-		612.500		0.001	0.054	7,200.000		0.316
Others	1.122		0.446		0.049	7,200.000	158.720	
CR Dense graded								
Benzene	0.034	12.821	14.815	0.039	0.054	7,200.000	5,715.073	15.045
Toluene	5.625		0.089		0.053	7,200.000	33.730	
ethylbenzene	1.125	40.000	0.444	0.013	0.052	7,200.000	167.992	4.725
p-Xylene	0.113		4.444		0.051	7,200.000	1,639.633	
Benzene, 1,2,4-trichloro-		612.500		0.001	0.054	7,200.000		0.316
Others	1.122		0.446		0.049	7,200.000	158.720	

Table S3. Results of the life cycle and risk assessment implemented in the ILCD midpoint method.

Impact category	Unit	Standard	CR Gap	CR Dense
Ozone depletion	kg CFC-11 eq	4.5×10^{-5}	3.4×10^{-5}	3.5×10^{-5}
Human toxicity, cancer effects	CTU	5.8×10^{-4}	4.0×10^{-4}	4.1×10^{-4}
Human toxicity, non-cancer effects	CTU	1.4×10^{-5}	3.2×10^{-5}	3.3×10^{-5}
Human toxicity_workers, cancer effects	CTU	1.2×10^{-6}	3.5×10^{-6}	1.0×10^{-6}
Human toxicity_workers, non-cancer effects	CTU	6.5×10^{-4}	8.1×10^{-4}	6.2×10^{-4}
Particulate matter	kg PM2.5 eq	1.0×10^{-1}	8.9×10^{-2}	9.1×10^{-2}
Photochemical ozone formation	kg NMVOC eq	1.7×10^0	1.4×10^0	1.5×10^0
Acidification	molc H ⁺ eq	1.6×10^0	1.3×10^0	1.3×10^0
Terrestrial eutrophication	molc N eq	5.8×10^0	5.0×10^0	5.1×10^0
Freshwater eutrophication	kg P eq	2.2×10^{-2}	1.3×10^{-2}	1.3×10^{-2}
Marine eutrophication	kg N eq	5.3×10^{-1}	4.6×10^{-1}	4.7×10^{-1}
Freshwater ecotoxicity	CTUe	5.8×10^3	4.0×10^3	4.1×10^3
Land use	kg C deficit	3.8×10^3	2.5×10^3	2.6×10^3
Water resource depletion	m ³ water eq	9.2×10^{-2}	6.0×10^{-2}	6.2×10^{-2}
Mineral, fossil & ren resource depletion	kg Sb eq	4.7×10^{-8}	3.7×10^{-8}	3.8×10^{-8}