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Supplementary Material for

Probabilistic Prediction Models and Influence Factors of Indoor Formaldehyde and VOC Levels in Newly Renovated Houses

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Table S1. Exposure parameters of the selected age groups in health risk assessment.

Description	Unit	Value				Source
		Man	Female	6–12 Boy	6–12 Girl	
body weight, BW	kg	70.6 ± 9.5	58.4 ± 8.8	34.7 ± 15.2	33.2 ± 12.6	Taiwan HPA 2008 [2]
inhalation rate, IR	m^3/day	18.3	12.3	10.6	9.84	Taiwan HPA 2008 [2]
exposure time, ET	h/day	12.8	13.7	12.8	13.7	Taiwan HPA 2008 [2]
exposure frequency, EF	days/y	340	340	340	340	Taiwan HPA 2008 [2]
exposure duration, ED	y	5	5	5	5	Liu and Zhang 2013 [1]
average lifetime, AT	y	78.1	84.7	78.1	84.7	Taiwan MOI 2020 [3]
Open rate of window	%	50	50	50	50	Assumed by this study

Table S2. Toxic parameters of the selected age groups in health risk assessment.

Compound	R*f*D value (mg/kg bw/day)	Critical Effect	Oral or Inhalation Slope Factor $(mg/kg\ bw/day)^{-1}$	Uncertainty Factor	Critical Effect	Source
Benzene	0.004	Decreased lymphocyte count	1.5×10^{-2} (oral) 1.0×10^{-1} (inhalation)	300	Hematologic Leukemia	IRIS, USEPA OEHHA, USEPA
Toluene	0.08	Increased kidney weight		3000		IRIS, USEPA
Ethyl Benzene	0.1	Liver and kidney toxicity	1.1×10^{-2} (oral) 8.7×10^{-3} (inhalation)	300	Renal tubule adenoma or carcinoma	IRIS, USEPA OEHHA, USEPA
m-Xylenes	0.2	Decreased body weight, increased mortality		300		IRIS, USEPA
p-Xylenes	0.2	Decreased body weight, increased mortality		300		IRIS, USEPA
o-Xylenes	0.2	Decreased body weight, increased mortality		300		IRIS, USEPA
Styrene	0.2	Red blood cell and liver effects, CNS effects		30		IRIS, USEPA
Formaldehyde	0.2	Reduced weight gain, histopathology in rats	2.1×10^{-2} (inhalation)	100	Squamous cell carcinoma	IRIS, USEPA OEHHA, USEPA

Table S3. The equation of indoor prediction models for the concentrations of formaldehyde and specific VOCs based on the multiple linear regressions.

Indoor Pollutants	Equation of Indoor Concentration Prediction Models
Formaldehyde	= –0.003 × RS + 0.015 × T – 0.001 × RH + 0.140 × CPM + 0.081 × LHP + 0.190 × VM + 0.071 × SF + 0.001 × CP + 0.283 × WF – 0.114 × OW – 0.151
Benzene	= –0.001 × RS + 0.003 × T + 0.001 × RH + 0.010 × CPM – 0.013 × LHP + 0.010 × VM + 0.002 × SF + 0.012 × CP + 0.008 × WF – 0.009 × OW – 0.058
Toluene	= –0.010 × RS + 0.273 × T + 0.019 × RH + 3.207 × CPM + 1.761 × LHP + 1.569 × VM + 1.860 × SF + 0.649 × CP + 0.447 × WF – 0.515 × OW – 8.334
Ethyl Benzene	= –0.001 × RS + 0.002 × T + 0.001 × RH + 0.025 × CPM + 0.004 × LHP + 0.002 × VM + 0.017 × SF + 0.001 × CP + 0.030 × WF – 0.010 × OW – 0.046
m-Xylene	= –0.001 × RS + 0.001 × T + 0.001 × RH + 0.014 × CPM + 0.005 × LHP + 0.001 × VM + 0.0014 × SF + 0.001 × CP + 0.022 × WF – 0.008 × OW – 0.030
p-Xylene	= –0.001 × RS + 0.002 × T + 0.001 × RH + 0.031 × CPM + 0.006 × LHP + 0.004 × VM + 0.002 × SF + 0.001 × CP + 0.051 × WF – 0.017 × OW – 0.054
o-Xylene	= –0.001 × RS + 0.002 × T + 0.001 × RH + 0.027 × CPM + 0.013 × LHP + 0.023 × VM + 0.008 × SF + 0.008 × CP + 0.064 × WF – 0.017 × OW – 0.045
Styrene	= –0.001 × RS + 0.014 × T– 0.006 × RH + 0.140 × CPM + 0.140 × LHP + 0.050 × VM + 0.181 × SF + 0.034 × CP + 0.630 × WF – 0.132 × OW – 0.012

RS: Room size (m^2); T: Indoor temperature (℃); RH: Indoor RH (%); CPM: Cold paint multi-layer wooden materials; LHP: Laminate hard plastic multi-layer materials; VM: Veneer multi-layer wooden materials; SF: Multi-layer materials for system furniture; CP: Cement paint; WF: Wooden floor; OW: Open window (%).

Table S4. Exposure dose of indoor formaldehyde and individual VOCs in the selected age groups.

Age groups/Compound	Average Exposure Dose Calculated by Equation	Exposure Dose Estimated by Monte Carlo Simulation		
	Mean	MCS mean	MCS P50	MCS P95
Adult (19-65 years old)				
Male				
Formaldehyde	3.64×10^{-6}	3.62×10^{-6}	2.47×10^{-6}	1.09×10^{-5}
VOCs				
Benzene	3.54×10^{-4}	3.51×10^{-4}	2.50×10^{-4}	1.00×10^{-3}
Toluene	2.15×10^{-2}	2.13×10^{-2}	1.45×10^{-2}	6.50×10^{-2}
Ethyl Benzene	1.84×10^{-4}	1.84×10^{-4}	1.37×10^{-4}	4.85×10^{-4}
m-Xylene	1.58×10^{-4}	1.57×10^{-4}	1.18×10^{-4}	4.05×10^{-4}
p-Xylene	3.37×10^{-4}	3.35×10^{-4}	2.39×10^{-4}	9.54×10^{-4}
o-Xylene	2.95×10^{-4}	2.94×10^{-4}	2.11×10^{-4}	8.22×10^{-4}
Styrene	1.95×10^{-3}	1.93×10^{-3}	1.32×10^{-3}	5.87×10^{-3}
Female				
Formaldehyde	3.16×10^{-6}	3.14×10^{-6}	2.15×10^{-6}	9.52×10^{-6}
VOCs				
Benzene	3.07×10^{-4}	3.06×10^{-4}	2.17×10^{-4}	8.75×10^{-4}
Toluene	1.86×10^{-2}	1.85×10^{-2}	1.25×10^{-2}	5.64×10^{-2}
Ethyl Benzene	1.60×10^{-4}	1.60×10^{-4}	1.19×10^{-4}	4.25×10^{-4}
m-Xylene	1.37×10^{-4}	1.37×10^{-4}	1.03×10^{-4}	3.53×10^{-4}
p-Xylene	2.93×10^{-4}	2.91×10^{-4}	2.07×10^{-4}	8.30×10^{-4}
o-Xylene	2.56×10^{-4}	2.56×10^{-4}	1.83×10^{-4}	7.22×10^{-4}
Styrene	1.69×10^{-3}	1.68×10^{-3}	1.15×10^{-3}	5.12×10^{-3}
Children (6-12 years old)				
Male				
Formaldehyde	4.30×10^{-6}	4.78×10^{-6}	2.97×10^{-6}	1.54×10^{-5}
VOCs				
Benzene	4.18×10^{-4}	4.65×10^{-4}	3.00×10^{-4}	1.42×10^{-3}
Toluene	2.54×10^{-2}	2.82×10^{-2}	1.73×10^{-2}	9.16×10^{-2}

Ethyl Benzene	2.18×10^{-4}	2.43×10^{-4}	1.66×10^{-4}	7.01×10^{-4}
m-Xylene	1.86×10^{-4}	2.08×10^{-4}	1.45×10^{-4}	5.82×10^{-4}
p-Xylene	3.98×10^{-4}	4.44×10^{-4}	2.87×10^{-4}	1.37×10^{-3}
o-Xylene	3.49×10^{-4}	3.89×10^{-4}	2.53×10^{-4}	1.18×10^{-3}
Styrene	2.31×10^{-3}	2.56×10^{-3}	1.58×10^{-3}	8.31×10^{-3}
Female				
Formaldehyde	4.48×10^{-6}	4.90×10^{-6}	3.10×10^{-6}	1.56×10^{-5}
VOCs				
Benzene	4.35×10^{-4}	4.76×10^{-4}	3.13×10^{-4}	1.44×10^{-3}
Toluene	2.64×10^{-2}	2.89×10^{-2}	1.81×10^{-2}	9.34×10^{-2}
Ethyl Benzene	2.27×10^{-4}	2.49×10^{-4}	1.73×10^{-4}	7.08×10^{-4}
m-Xylene	1.94×10^{-4}	2.13×10^{-4}	1.50×10^{-4}	5.91×10^{-4}
p-Xylene	4.15×10^{-4}	4.55×10^{-4}	3.00×10^{-4}	1.37×10^{-3}
o-Xylene	3.63×10^{-4}	3.99×10^{-4}	2.64×10^{-4}	1.19×10^{-3}
Styrene	2.40×10^{-3}	2.63×10^{-3}	1.65×10^{-3}	8.43×10^{-3}

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