Supplementary Materials

Table S1 Chemical composition of MSWI fly ash and water-washed MSWI fly ash

Major components	Value (wt %)		Trace elements	Value (mg kg^{-1})	
	FA	WFA		FA	WFA
CaO	32.16	37.56	Zn	3591	4894
Cl	9.93	2.20	Cu	2733	3523
SiO_2	15.4	25.3	Mn	2245	2743
SO_3	4.26	5.12	Pb	541	690
Al_2O_3	11.47	12.14	Cr	42	45
Na_2O	4.63	1.22	Ni	105	179
K_2O	2.66	1.07	Cd	71	77
Fe_2O_3	5.43	6.91			
MgO	3.05	3.22			
P_2O_5	3.49	4.07			
others	7.52	1.19			

Table S2 Definition, value and instruction of exposure factors

Parameters	Definition	Unit	Sensitive		Non-sensitive
			Adults	Children	Adults
PM10	Content of inhalable particulates in ambient air	mg/m^3	0.15	0.15	0.15
ED	Exposure duration	a	24	6	25
EF	Exposure frequency	d/a	350	350	250
EFI	Indoor exposure frequency	d/a	262.5	262.5	187.5
EFO	Outdoor exposure frequency	d/a	87.5	87.5	62.5
BW	Average body weight	kg	56.8	15.9	56.8
H	Average height	cm	156.3	99.4	156.3
DAIR	Daily air inhalation rate	m^3/d	14.5	7.5	14.5
OSIR	Daily oral ingestion rate of soil	mg/d	100	200	100
Ev	Daily exposure frequency of dermal contact event	1/d	1	1	1
fspi	Fraction of soil-borne particulates in indoor air		0.8	0.8	0.8
fspo	Fraction of soil-borne particulates in outdoor air		0.5	0.5	0.5
SAF	Soil allocation factor		0.2	0.2	0.2
SER	Skin exposure ratio		0.32	0.36	0.18
SSAR	Adherence rate of soil on skin	mg/cm^2	0.07	0.2	0.2
PIAF	Retention fraction of inhaled particulates in body		0.75	0.75	0.75
ABS0	Absorption factor of oral ingestion		1	1	1
ACR	Acceptable cancer risk for individual contaminant		1×10^{-6}	1×10^{-6}	1×10^{-6}
AHQ	Acceptable hazard quotient for individual contaminant		1	1	1
Atca	Average time for carcinogenic effect	d	26280	26280	26280
Atnc	Average time for non-carcinogenic effect	d	2190	2190	9125
SAE	Skin surface area	cm^2	5075	2448	2855

Table S3 Toxicological indices of the investigated heavy metals

Heavy metal	The carcinogenic slope factors of oral ingestion	The unit carcinogenic factor of inhalation	Reference doses of oral ingestion	Reference dose of inhalation	The gastrointestinal absorption factor	Absorption factor of dermal contact
	SFo	IUR	RfDo	RfC	ABSgi	ABSd
	1/(mg/kg/d)	1/(mg/m^3)	mg/kg/d	mg/m^3	-	-
Cu	-	-	4.00E-02	1.87E-01	1.00E+00	1.00E-02
Zn	-	-	3.00E-01	1.40E+00	1.00E+00	1.00E-02
Cd	-	1.80E+00	1.00E-03	1.00E-05	2.50E-02	1.00E-03
Pb	-	-	-	5.00E-04	1.00E+00	1.00E-02
Cr(VI)	5.00E-01	8.40E+01	3.00E-03	1.00E-04	2.50E-02	1.00E-02
Ni	-	2.60E-01	2.00E-02	9.00E-05	4.00E-02	1.00E-02

Table S4 Grain size distribution of sand in Chinese standard (Ministry of housing and urban-rural development of China, 2006)（accumulated retained percentage，wt %）

Size	Zone I	Zone II	Zone III
5.00mm	10~0	10~0	10~0
2.50mm	35~5	25~0	15~0
1.25mm	65~35	50~10	25~0
630μm	85~71	70~41	40~16
315μm	95~80	92~70	85~55
160μm	100~90	100~90	100~90

Table S5 Strength of series 1 and the computation results of MSWI fly ash cementing efficiency

P[a]	0	2	3	10	15	20	25
Compressive strength (MPa)	29.0	28.5	27.7	26.1	24.5	22.7	21.1
Cementing efficiency, k		0.36	0.31	0.21	0.19	0.16	0.15

[a]P is the mass ratio of fly ash to binder, where binder is the sum of fly ash and cement.