SUPPLEMENTARY MATERIALS FOR

CHARACTERIZATION, DISTRIBUTION, AND RISK ASSESSMENT OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) IN THE WORKPLACES OF AN ELECTRIC ARC FURNACE (EAF) STEELMAKING FACTORY

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SAMPLE ANALYSES

For PAHs analysis, concentrations of 22 PAH compounds (See table S1) were determined. Each filter and sorbent tube sample collected was placed in a solvent solution (the mixture of *n*-hexane and dichloromethane, v:v = 1:1, respectively), and extracted in a Soxhlet extractor for 24 h. The extract was then concentrated, cleaned-up and re-concentrated to exactly 1.0 mL or 0.5 mL. PAH content was determined by using a gas chromatograph (GC) (Hewlett-Packard 5890A) with a mass selective detector (MSD) (Hewlett-Packard 5972) and a computer workstation. This GC/MS was equipped with a Hewlett-Packard capillary column (HP Ultra 2–50 m×0.32 mm×0.17 μm), and HP-7673A automatic sampler, injection volume 1μL, splitless injection at 310 °C, ion sources temperature at 310 °C, oven temperature from 50 °C to 100 °C at 20 °C/min; 100 °C to 290 °C at 3 °C/min; and hold at 290 °C for 40 min. The masses of primary and secondary ions of PAHs were determined using the scan mode for pure PAH standards. Qualification of PAHs was performed using the selected ion monitoring (SIM) mode (Chang et al., 2014; Chen et al., 2017; Wang et al., 2007, 2009)

QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Analysis of the serial dilution of PAH standards shows that the limit of detection (LOD) of GC/MS was 0.096–1.48 ng. Five internal standards (Nap-d8, Acp-d10, PA-d10, CHR-d12, and PER-d12) were used to check the response factors and recovery efficiencies for PAHs analysis. The recovery efficiencies of 22 individual PAHs and these five internal standards were determined by processing a solution containing known PAH concentrations through the same experimental procedure that was used for analyzing samples. The recovery efficiency of PAHs varied between 0.806 and 0.925 in this study. The above values were used to adjust the observed concentration. The mean relative standard deviation (RSD) (%) of recovery efficiencies was 3.97% (range

1.34–10.4%). The blank tests for PAHs were accomplished by the same procedure as the recovery-efficiency tests without adding the known standard solution before extraction.

CALCULATING BAP EQUIVALENT CONCENTRATIONS

Because BaP has been known to be the most carcinogenic PAH compound, the carcinogenic potency of each collected sample was also determined in terms of its BaP equivalent concentration (BaP_{eq}). The carcinogenic potency of the total PAHs exposures could then be estimated as the sum of each individual BaP_{eq}. To calculate the BaP_{eq} for each individual PAH species, it requires the use of its toxic equivalent factor (TEF) for the given species relative to BaP carcinogenic potency. To date, only a few proposals for TEFs are available (Nisbet & Lagoy', 1992; Thorslund et al., 1990). From these, the list of TEFs completed by Nisbet and LaGoy were adopted in this study (Table S1), as these have been demonstrated to be a better reflection of the actual state of knowledge on the toxic potency of each individual PAH species relative to BaP (Petryl et al., 1996).

Table S1 PAHs and their toxic equivalent factors (TEFs) suggested by Nisbet and LaGoy in 1992.

PAHs	TEF
Naphthalene (Nap)	0.001
Acenaphthylene (Acp)	0.001
Acenaphthene (Ace)	0.001
Fluorene (Flu)	0.001
Phenanthrene (Phe)	0.001
Anthracene (Ant)	0.01
Fluoranthene (Fla)	0.001
Pyrene (Pyr)	0.001
Cyclopenta(c,d)pyrene (CyP)	-*
Benzo(a)anthracene (BaA)	0.1
Chrysene (Chr)	0.01
Benzo(b)fluoranthene (BbF)	0.1
Benzo(k)fluoranthene (BkF)	0.1
Benzo(e)pyrene (BeP)	-*
Benzo(a)pyrene (BaP)	1
Perylene (Per)	-*
Indeno(1,2,3,-cd)pyrene (IdP)	0.1
Dibenzo(a,h)anthracene (DbA)	1
Benzo(b)chrycene (BbC)	-*
Benzo(ghi)perylene (BghiP)	0.01
Coronene (Cor)	1
Dibenzo[*a,e*]pyrene (DbP)	-*

*No TEF has been suggested.

Table S2. Parameters used in health risk assessment and their probability distribution (Adopted from: Qishlaqi & Beiramali, 2019)

Parameters	**Abbreviation**	**Unit**	**For Adult**
Carcinogenic slope factor	CSF	$[mg/kg\text{-}day]^{-1}$	3.14 ± 1.80
Inhalation rate	IR	m^3/day	32.73 ± 1.14
Exposure frequency	EF	h/day (for 6 days/week)	8-12
Exposure duration	ED	years	25-40
Conversion factor	CF	mg/µg	0.001
Body weight	BW	kg	77.45 ± 13.60
Life Expectancy (70 years)	LE	days	25,550

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