



Corrigendum to “PM_{2.5} Emissions from Hand-Held Sparklers: Chemical Characterization and Health Risk Assessment” [*Aerosol Air Qual. Res.* 14: 1477–1486]

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The authors regret that inadvertent errors occurred in the estimation of excess lifetime cancer risk (ELCR) in the above-referenced paper due to an oversight. Specifically, the slope factor of nickel (Ni) we used in the ELCR calculation should have been $8.4 \times 10^{-1} (\text{mg/kg/day})^{-1}$ instead of $8.4 \times 10^1 (\text{mg/kg/day})^{-1}$. Further, to be consistent with other publications where we assumed the measured chromium (Cr) to exist entirely as hexavalent chromium (Cr(VI)) in airborne particulate matter, we revised the slope factor of Cr to the USEPA recommended value of 42 and recalculated the ELCR accordingly. These revised slope factors do not affect, or influence our overall qualitative conclusion made earlier in the published paper in that whistling sparklers have higher carcinogenic risk compared to low smoke and colored sparklers. The revised ELCR estimates are given below in Tables 2, 3 and 4.

The authors apologize for any inconvenience caused.

DOI of original article: 10.4209/aaqr.2013.07.0255

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Table 2. Health risk estimates for water soluble metals and PAHs in PM_{2.5} emissions from (a) LSS (b) WS (c) CS for adults (no dilution condition).

| | CDI (mg/kg/day) | PEF | SF (mg/kg/day) ⁻¹ | ELCR |
|--------------------------------|------------------------|------|------------------------------|--------------------------------|
| (a) Low smoke sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 8.50×10^{-10} | | 42 | 3.57×10^{-8} |
| Co | 6.00×10^{-9} | | 32 | 1.92×10^{-7} |
| Ni | 8.20×10^{-10} | | 0.84 | 6.89×10^{-10} |
| Cd | 2.70×10^{-10} | | 6.3 | 1.70×10^{-9} |
| PAHs | | | | |
| Naph | 1.90×10^{-7} | | 0.12** | 2.28×10^{-8} |
| BaA | 2.30×10^{-7} | 0.1 | 0.31 | 7.13×10^{-8} |
| BbF | 5.30×10^{-7} | 0.1 | 0.31 | 1.64×10^{-7} |
| BkF | 1.90×10^{-8} | 0.01 | 0.031 | 5.89×10^{-10} |
| BaP | 3.00×10^{-8} | 1 | 3.1 | 9.30×10^{-8} |
| Ind | 1.30×10^{-7} | 0.1 | 0.31 | 4.03×10^{-8} |
| DBA | 3.80×10^{-8} | 1 | 3.1 | 1.18×10^{-7} |
| | | | | $\Sigma = 7.40 \times 10^{-7}$ |
| (b) Whistling sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 1.20×10^{-6} | | 42 | 5.04×10^{-5} |
| Co | 1.80×10^{-7} | | 32 | 5.76×10^{-6} |
| Ni | 1.70×10^{-7} | | 0.84 | 1.43×10^{-7} |
| Cd | 4.30×10^{-9} | | 6.3 | 2.71×10^{-8} |
| PAHs | | | | |
| Naph | 1.30×10^{-7} | | 0.12** | 1.56×10^{-8} |
| BaA | 6.70×10^{-8} | 0.1 | 0.31 | 2.08×10^{-8} |
| BbF | 1.50×10^{-7} | 0.1 | 0.31 | 4.65×10^{-8} |
| BkF | Not detected | 0.01 | 0.031 | |
| BaP | 1.00×10^{-8} | 1 | 3.1 | 3.10×10^{-8} |
| Ind | 4.70×10^{-8} | 0.1 | 0.31 | 1.46×10^{-8} |
| DBA | 2.30×10^{-8} | 1 | 3.1 | 7.13×10^{-8} |
| | | | | $\Sigma = 5.65 \times 10^{-5}$ |
| (c) Colored Sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 5.30×10^{-9} | | 42 | 2.23×10^{-7} |
| Co | 2.60×10^{-8} | | 32 | 8.32×10^{-7} |
| Ni | 2.00×10^{-8} | | 0.84 | 1.68×10^{-8} |
| Cd | 1.80×10^{-9} | | 6.3 | 1.13×10^{-8} |
| PAHs | | | | |
| Naph | 2.40×10^{-7} | | 0.12** | 2.88×10^{-8} |
| BaA | 7.70×10^{-9} | 0.1 | 0.31 | 2.39×10^{-9} |
| BbF | 8.10×10^{-9} | 0.1 | 0.31 | 2.51×10^{-9} |
| BkF | Not detected | 0.01 | 0.031 | |
| BaP | Not detected | 1 | 3.1 | |
| Ind | 2.90×10^{-8} | 0.1 | 0.31 | 8.99×10^{-9} |
| DBA | 1.70×10^{-8} | 1 | 3.1 | 5.27×10^{-8} |
| | | | | $\Sigma = 1.18 \times 10^{-6}$ |

* For ELCR calculations, Cr is assumed to be entirely in the Cr (VI) the state; SFs of toxic trace elements were obtained from the US EPA Integrated Risk Information System (IRIS) (www.epa.gov/iris).

** the California EPA, the office of Environmental Health Hazard Assessment (OEHHA) (<https://oehha.ca.gov>); for other PAHs, the SFs were obtained from the Risk Assessment Information Systems (<https://rais.ornl.gov/tutorials/toxval.html>).

PEF – Potency Equivalency Factors; CDI – Chronic daily intake; SF – Slope factor; ELCR – Excess lifetime cancer risk. SFs of PAHs were calculated by multiplying SF of BaP (= 3.1 (mg/kg/day)⁻¹) by the corresponding PEF.

Table 3. Health risk estimates for water soluble metals and PAHs in PM_{2.5} emissions from (a) LSS (b) WS (c) CS for children (no dilution condition).

| | CDI (mg/kg/day) | PEF | SF (mg/kg/day) ⁻¹ | ELCR |
|--------------------------------|-----------------------|------|------------------------------|--------------------------------|
| (a) Low smoke sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 6.00×10^{-9} | | 42 | 2.52×10^{-7} |
| Co | 4.20×10^{-8} | | 32 | 1.34×10^{-6} |
| Ni | 5.70×10^{-9} | | 0.84 | 4.79×10^{-9} |
| Cd | 1.90×10^{-9} | | 6.3 | 1.20×10^{-8} |
| PAHs | | | | |
| Naph | 1.40×10^{-6} | | 0.12** | 1.68×10^{-7} |
| BaA | 1.60×10^{-6} | 0.1 | 0.31 | 4.96×10^{-7} |
| BbF | 3.70×10^{-6} | 0.1 | 0.31 | 1.15×10^{-6} |
| BkF | 1.40×10^{-7} | 0.01 | 0.031 | 4.34×10^{-9} |
| BaP | 2.10×10^{-7} | 1 | 3.1 | 6.51×10^{-7} |
| Ind | 9.00×10^{-7} | 0.1 | 0.31 | 2.79×10^{-7} |
| DBA | 2.60×10^{-7} | 1 | 3.1 | 8.06×10^{-7} |
| | | | | $\Sigma = 5.16 \times 10^{-6}$ |
| (b) Whistling Sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 8.70×10^{-6} | | 42 | 3.65×10^{-4} |
| Co | 1.30×10^{-6} | | 32 | 4.16×10^{-5} |
| Ni | 1.20×10^{-6} | | 0.84 | 1.01×10^{-6} |
| Cd | 3.00×10^{-8} | | 6.3 | 1.89×10^{-7} |
| PAHs | | | | |
| Naph | 9.40×10^{-7} | | 0.12** | 1.13×10^{-7} |
| BaA | 4.70×10^{-7} | 0.1 | 0.31 | 1.46×10^{-7} |
| BbF | 1.00×10^{-6} | 0.1 | 0.31 | 3.10×10^{-7} |
| BkF | Not detected | 0.01 | 0.031 | |
| BaP | 7.30×10^{-8} | 1 | 3.1 | 2.26×10^{-7} |
| Ind | 3.30×10^{-7} | 0.1 | 0.31 | 1.02×10^{-7} |
| DBA | 1.60×10^{-7} | 1 | 3.1 | 4.96×10^{-7} |
| | | | | $\Sigma = 4.10 \times 10^{-4}$ |
| (c) Colored Sparklers | | | | |
| Heavy metals | | | | |
| Cr* | 3.70×10^{-8} | | 42 | 1.55×10^{-6} |
| Co | 1.80×10^{-7} | | 32 | 5.76×10^{-6} |
| Ni | 1.40×10^{-7} | | 0.84 | 1.18×10^{-7} |
| Cd | 1.30×10^{-8} | | 6.3 | 8.19×10^{-8} |
| PAHs | | | | |
| Naph | 1.60×10^{-6} | | 0.12** | 1.92×10^{-7} |
| BaA | 5.40×10^{-8} | 0.1 | 0.31 | 1.67×10^{-8} |
| BbF | 5.70×10^{-8} | 0.1 | 0.31 | 1.77×10^{-8} |
| BkF | Not detected | 0.01 | 0.031 | |
| BaP | Not detected | 1 | 3.1 | |
| Ind | 2.00×10^{-7} | 0.1 | 0.31 | 6.20×10^{-8} |
| DBA | 1.20×10^{-7} | 1 | 3.1 | 3.72×10^{-7} |
| | | | | $\Sigma = 8.17 \times 10^{-6}$ |

* For ELCR calculations, Cr is assumed to be entirely in the Cr (VI) the state; SFs of toxic trace elements were obtained from the US EPA Integrated Risk Information System (IRIS) (www.epa.gov/iris).

** the California EPA, the office of Environmental Health Hazard Assessment (OEHHA) (<https://oehha.ca.gov>); for other PAHs, the SFs were obtained from the Risk Assessment Information Systems (<https://rais.ornl.gov/tutorials/toxval.html>).

PEF – Potency Equivalency Factors; CDI – Chronic daily intake; SF – Slope factor; ELCR – Excess lifetime cancer risk. SFs of PAHs were calculated by multiplying SF of BaP (= 3.1 (mg/kg/day)⁻¹) by the corresponding PEF.

Table 4. ELCR estimated at various dilution conditions.

| Dilution Factor | Low smoke sparkler | | Whistling sparkler | | Colored sparkler | |
|--------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Adults | Children | Adults | Children | Adults | Children |
| 0 | 7.40×10^{-7} | 5.16×10^{-6} | 5.65×10^{-5} | 4.10×10^{-4} | 1.18×10^{-6} | 8.17×10^{-6} |
| 10 | 7.40×10^{-8} | 5.16×10^{-7} | 5.65×10^{-6} | 4.10×10^{-5} | 1.18×10^{-7} | 8.17×10^{-7} |
| 100 | 7.40×10^{-9} | 5.16×10^{-8} | 5.65×10^{-7} | 4.10×10^{-6} | 1.18×10^{-8} | 8.17×10^{-8} |
| 410 | 1.80×10^{-9} | 1.26×10^{-8} | 1.38×10^{-7} | 1.00×10^{-6} | 2.88×10^{-9} | 1.99×10^{-8} |
| 1000 | 7.40×10^{-10} | 5.16×10^{-9} | 5.65×10^{-8} | 4.10×10^{-7} | 1.18×10^{-9} | 8.17×10^{-9} |