1   **Table S1:** UW HSRL Transmitter Specifications

Parameter	Value
Wavelength	532 nm
Pulse Repetition Rate	4 KHz
Average Power	0.25 W

Table S2: Limits of detection (LOD) of water-soluble ions and elements. Species are divided based on analysis (IC: adipate to SO_4^{2-} in ppb; ICP-QQQ: Ag to Zr in ppt).

IC	LOD	ICP-QQQ	LOD
adipate	22.655	Ag	0.743
NH_4^+	42.434	Al	29.474
Ca^{2+}	45.229	As	7.945
Cl^-	2.144	Ba	3.698
DMA	52.709	Cd	4.194
Mg^{2+}	36.925	Co	0.722
maleate	6.970	Cr	1.150
MSA	12.316	Cs	0.733
NO_3^-	8.917	Cu	1.127
oxalate	12.312	Fe	1.191
phthalate	20.685	Hf	0.963
Na^+	43.476	K	10.480
succinate	11.046	Mn	1.624
SO_4^{2-}	11.982	Mo	2.258
		Nb	0.522
		Ni	2.837
		Pb	0.503
		Rb	1.566
		Se	82.393
		Sn	1.772
		Sr	1.102
		Ti	39.046
		Tl	0.383
		V	1.353
		Y	0.523
		Zn	5.880
		Zr	1.008

7   **Table S3:** Assigned values of κ and density (ρ) for pure compounds used in the hygroscopicity
8   analysis. Organics refer to those not measured by IC. (a: Almeida et al. (2019) and references
9   therein; b: Drozd et al. (2014); c: Hersey et al. (2013); d: Pöschl et al. (2019); e: Dusek et al.
10 (2010); f: Rose et al. (2010); g: Laborde et al. (2012); and h: Aldhaif et al. (2018)).

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Species	κ	ρ (g cm^{-3})
$(NH_4)_2SO_4$	0.61 [a]	1.77
K_2SO_4	0.69 [a]	2.66
$Mg(NO_3)_2$	0.63 [a]	2.30
$NaNO_3$	0.87 [a]	2.26
Na_2SO_4	0.76 [a]	2.66
$CaCl_2$	0.78 [a]	2.15
$MgCl_2$	0.98 [a]	2.32
$Ca(NO_3)_2$	1.10 [a]	2.50
Ca_2SO_4	0.00 [a]	2.32
$MgSO_4$	0.24 [a]	2.66
Na_2Oxalate	0.68 [b]	2.34
CaOxalate	0.02 [b]	2.12
MgOxalate	0.05 [b]	2.45
ZnOxalate	0.02 [b]	2.56
NaCl	1.24 [a]	2.16
organics	0.10 [c,d,e]	1.40 [h]
black carbon	0.00 [f,g]	2.00 [h]

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Figure S1: Manila Observatory, Quezon City (red star) is within the heavily urbanized areas
(gray) in and around Metro Manila, Philippines. It is located west of the Marikina Valley,
southwest of the Sierra Madre Mountains, east of Manila Bay, and north of Laguna Lake.

18
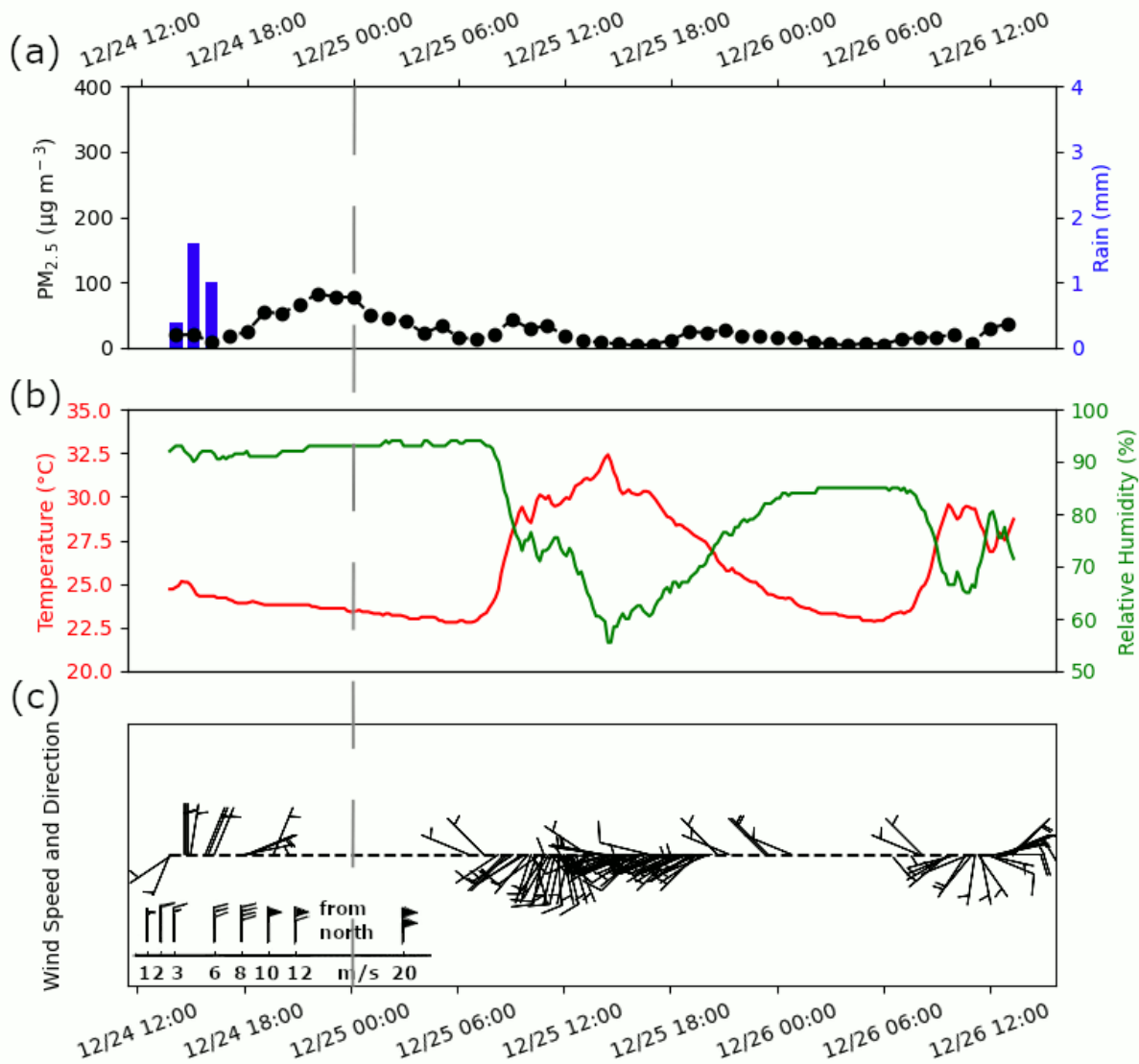
Figure S2: (a) PM$_{2.5}$ mass concentrations and rain accumulation at hourly resolution as measured at the Manila Observatory before the firework event (local time, dashed vertical line indicates midnight). Ten-minute averaged values of (b) temperature and relative humidity, in addition to (c) wind speed and direction. The wind barb legend in (c) shows how flags are added to the staff with increasing wind speed and in the direction where the wind comes from.

24
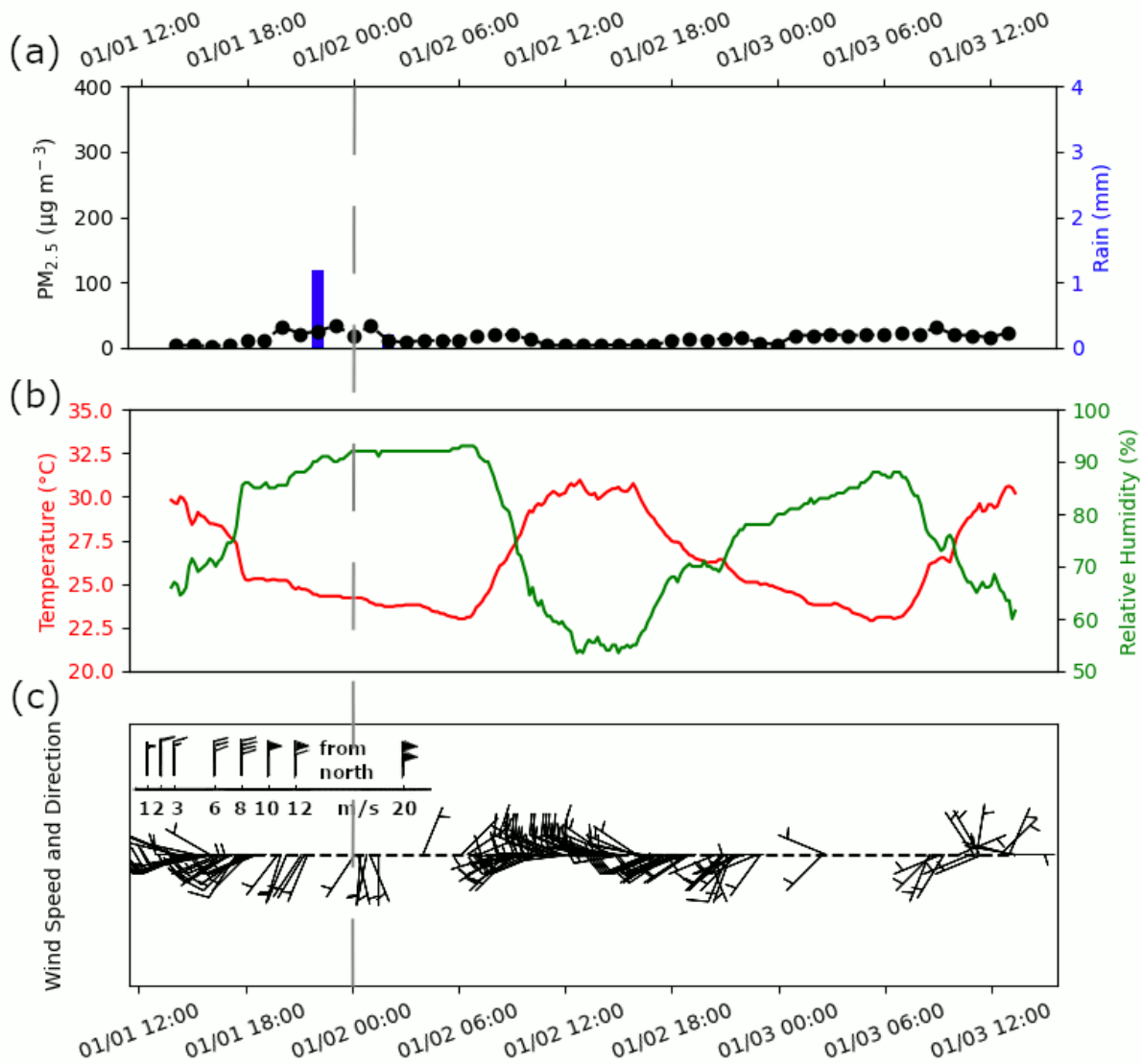
Figure S3: Same as Fig. S2 but for after the firework event.

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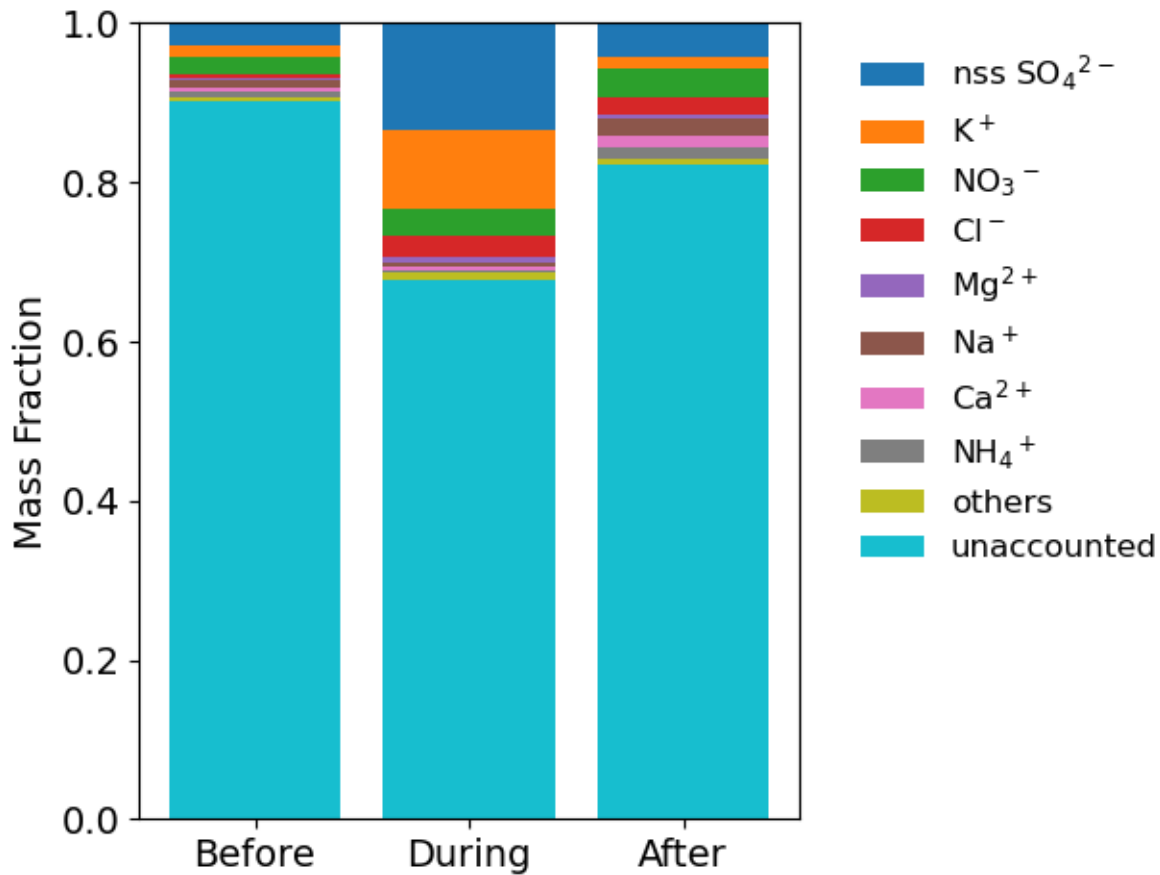


Figure S4: Mass fraction of water-soluble species (0.056 – 3.2 μm) from 48-hour samples collected on MOUDI samplers before, during, and after the firework event. Speciated concentrations were compared to hourly $PM_{2.5}$ concentrations as measured by a beta-attenuation monitor that were averaged over 48 hours.

31

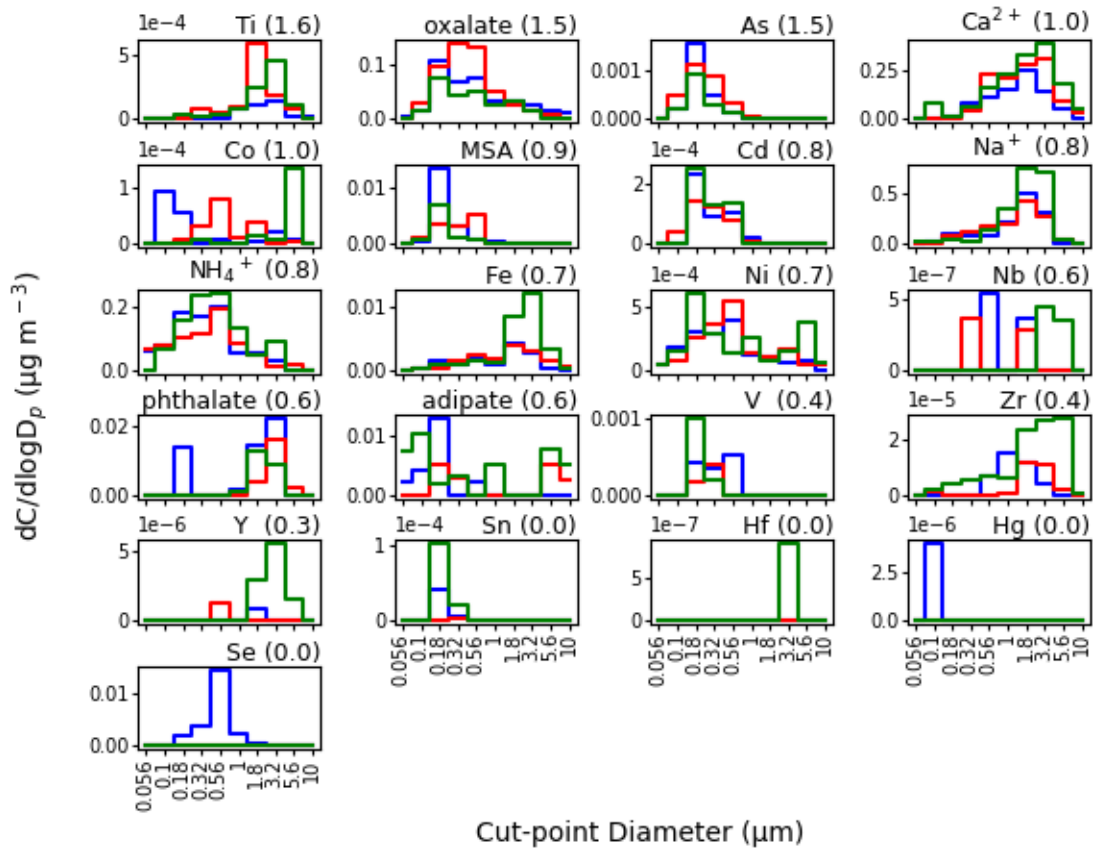



Figure S5: Speciated mass size distributions before (blue), during (red), and after (green) the firework event. Next to species labels are bulk ($\geq 0.056\ \mu m$) mass concentration enrichment values due to the firework event; species are shown here that exhibited enrichments ≤ 1.6.

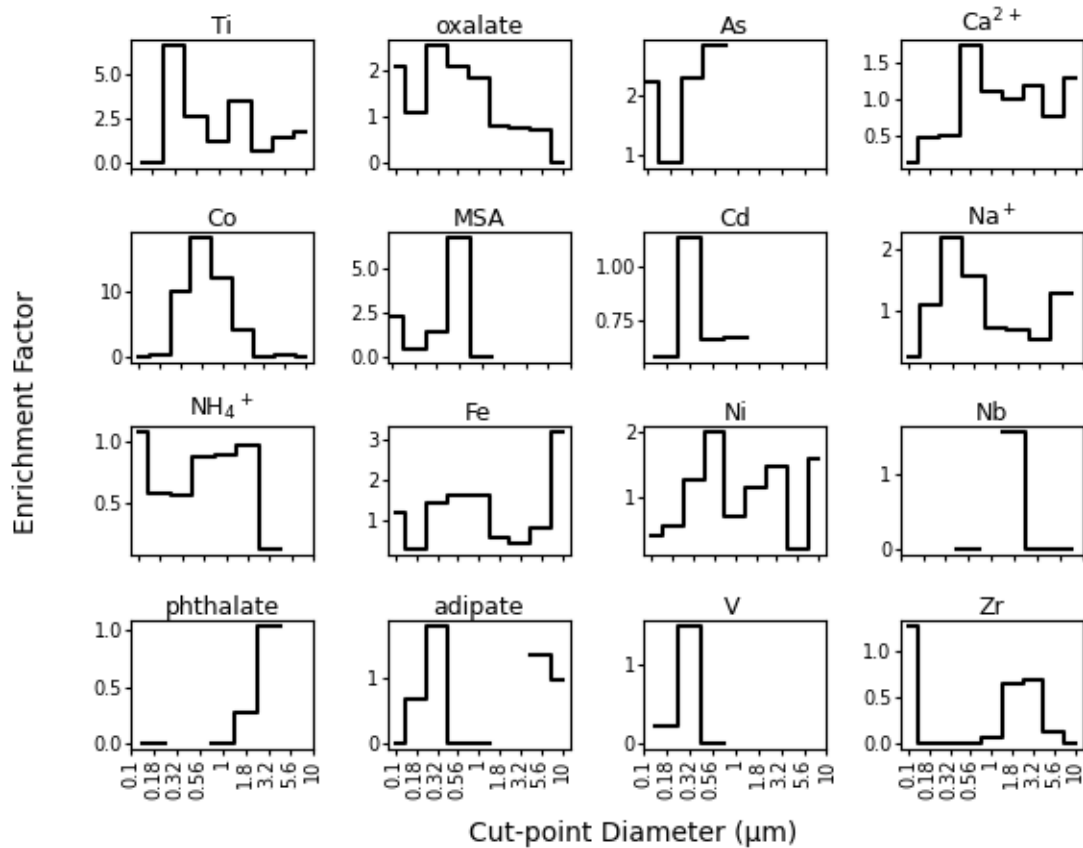
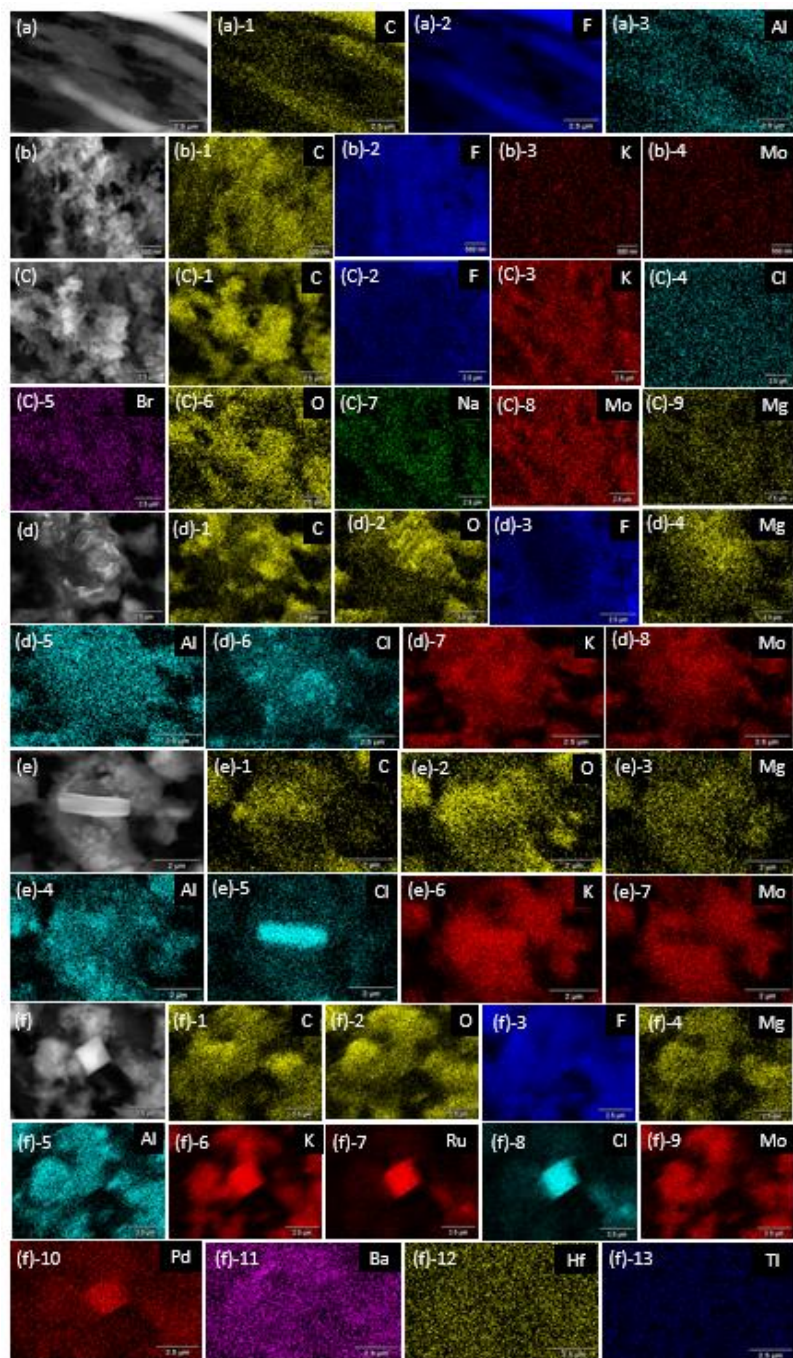



Figure S6: Size-resolved enrichments for individual firework tracer species in order of decreasing total bulk mass concentration enrichment (species from Fig. S5). Cut-point diameters with no valid data are left blank.

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41 **Figure S7:** SEM images (gray-scale) and x-ray elemental maps from SEM-EDX of (a) a blank
42 PTFE (Teflon) substrate, and samples with firework influence in the following diameter ranges:
43 (b) 0.1 – 0.18 μm, (c) 0.18 – 0.32 μm, (d) 0.32 – 0.56 μm, and (e-f) 0.56 – 1.0 μm. The color
44 density of the elemental maps is related to the concentration for the particular element (upper
45 right of each map) in the x-ray maps relative to the backscattered electron image (gray-scale).