

Interactive comment on “Fine particles from Independence Day fireworks events: chemical characterization and source apportionment” by Jie Zhang et al.

Anonymous Referee #2

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Paper Summary: This paper reports on the chemical composition of fireworks from the 2017 independence day celebration in Albany, NY. The chemical composition of the fireworks were measured using an Aerodyne type Aerosol Mass Spectrometer. Data from 2 sites was used to investigate transport and other properties of the aerosols in the plumes. Overall, the paper investigates an interesting phenomenon with applications to other celebrations which utilize fireworks, however, the analysis is lacking in a few key areas, and further analysis is warranted before the paper can be published in ACP.

General Comments: The accurate measurement of potassium (K) with an AMS is difficult. Potassium readily ionizes on the 600 C surface of the heater via surface

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ionization. Tuning/detuning of the heater bias in the instrument is important to minimize the surface ionization signal in the resulting mass spectrum since it is not quantitative. The difference in noted RIE for K in this work compared to other work is likely due to different tuning of the instruments and enhancements in surface ionization generated K in this work (page 6 lines 9-14). Ion signals resulting from K surface ionization at m/z 39/41 are more broad than other ion signals as a result of the ionization occurring in a spatially separate area of the ionization region of the AMS compared to EI ionization. The authors are encouraged to look at and include the raw mass spectra signal for these ions in supplementary information (e.g. see supplementary section in Aiken et al. 2009). Given the uncertainty in the K and the lack of details in the paper, the organic potassium discussion and ion balance may need to be removed or updated with additional analysis. On page 3 line 5, the authors state that potassium evaporates and ionizes slowly. This is not always the case, and is dependent on the anion paired with K. KNO₃ boils at 400 C, lower than the vaporizer temperature of the AMS, while K₂SO₄ boils at nearly 1700 C, so will take much longer to come off of the vaporizer.

The measurements were performed at 2 different sites approximately 9 km apart (Page 3 line 9). Another key difference in sites is the sampling heights which is mentioned, but not discussed in detail. The ASRC site measures at an altitude of 81m, whereas the ACHD site measures at only 8 m above the ground. Is there anyway to clearly identify that the plumes measured at the 2 sites are similar? Could local emissions from people at the ground and commercially available fireworks/sparklers be contributing to the lower sampling height ASRC? As the authors indicate, the lidar data suggests an elevated plume at 400 m, so are the lower altitude sampling locations more likely sampling ground level emissions mixing up, or higher altitude emissions mixing down? This is an important question since the chemical composition may either be for large fireworks or for consumer fireworks which may have significant differences (e.g. sparklers vs rockets etc.).

The PMF analysis of the data is interesting, but the authors provide no details in why

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the 5 factor solution was chosen over higher or lower factor solutions. Did the authors investigate any rotation of the data using the peak parameters? In the supplementary, the mass spectrum for the HOA spectra has a higher signal from m/z 55 than 57, this may indicate a mixed cooking and traffic factor (see Mohr et al. 2012). Figure 5 indicates that the difference between the FW and the LV-OOA is primarily due to lower m/z 44 (and by frag-table extension m/z 28) and BBOA markers 60 and 73. While this graphic is useful, it may be more helpful to show this as a % change: (LV-OOA-FW-OOA)/LV-OOA * 100% (e.g. Alfarra et al. 2006). Further, given that BBOA is also elevated anytime the FW-OOA is elevated, could these two factors be "trading mass" to make up for non-static source mass spectra?

Specific Comments: Page 4 line 9: With a 9 meter inlet and a silica diffusion dryer, could the authors comment on the estimated line losses from their sampling inlet?

Figure 7 should remind the reader of the EDT UTC time difference, or better, change the axis to local time (EDT).

References: Aiken, A. C., et al.: Mexico City aerosol analysis during MILAGRO using high resolution aerosol mass spectrometry at the urban supersite (T0) - Part 1: Fine particle composition and organic source apportionment, 9(17), 6633–6653, 2009.

Alfarra, M. R., et al.: A mass spectrometric study of secondary organic aerosols formed from the photooxidation of anthropogenic and biogenic precursors in a reaction chamber, ACP, 6(12), 5279–5293, 2006.

Mohr, C., et al.: Identification and quantification of organic aerosol from cooking and other sources in Barcelona using aerosol mass spectrometer data, ACP, 12(4), 1649–1665, 2012

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