

Executive Summary

- Formaldehyde was successfully measured with a proton transfer reaction mass spectrometer (PTR-MS) instrument at the Moody Tower site during the Study of Houston Atmospheric Radical Precursors (SHARP) field campaign. This was done by passing the sample air continuously through a tube cooled to $-30\text{ }^{\circ}\text{C}$ to remove water vapor. Sensitivity to formaldehyde was increased by a factor of 7 using this approach. The method was tested in the lab and verified in the field.
- The PTR-MS measured formaldehyde and 25 other organic species from April 14 to May 31. These species included the photoproducts peroxyacetic nitric anhydride (PAN) and methyl hydroperoxide. The methyl hydroperoxide measurements were the first performed by the PTR-MS instrument. The species acetic acid and formic acid did not pass efficiently through the cold tube and were not successfully quantified.
- During periods of southerly wind flow (May 4 - May 16) formaldehyde mixing ratios displayed a distinct diel cycle with an early afternoon high (average 1.7 ± 0.3 ppbv) and an early morning low (average 0.9 ± 0.15 ppbv). Formaldehyde was positively correlated with methyl vinyl ketone and methacrolein. Formaldehyde also displayed a positive correlation with PAN. The correlations are evidence that isoprene photooxidation was the principal source of formaldehyde under these flow conditions. During this period formaldehyde was not correlated with CO mixing ratios and there was no evidence of significant rush hour emissions of formaldehyde from vehicles.
- During periods when wind flow was from the north-east sector the Moody Tower site was impacted by Houston Ship Channel (HSC) emissions. During this time (May 17 – May 23) formaldehyde displayed no diel cycle and mixing ratios were consistently higher through the day and night compared to the southerly flow data. The absence of a clear diel cycle and persistently elevated mixing ratios at night (on average > 2 ppbv) suggest the presence of continuous primary formaldehyde emissions. Formaldehyde was not well correlated with PAN or methyl hydroperoxide. Formaldehyde was positively correlated with a broad range of volatile organic compounds during this period.
- During periods when wind flow was from the north-east sector and impacted by HSC emissions, formaldehyde was strongly correlated with acetaldehyde and acetone. Mixing ratios of acetaldehyde and acetone were similar to those of formaldehyde.
- Five formaldehyde plume events were observed in May. Notably these were also acetaldehyde events, with formaldehyde to acetaldehyde ratios varying from 0.5 to 1.1. These events lasted at most 2 hours and were characterized by rapid increases in formaldehyde mixing ratios to more than double previous levels. The highest

formaldehyde mixing ratio observed was 11.8 ppbv. In 3 of these events acrylonitrile ($m/z = 54$) was also elevated suggesting a particular emission source or process. Acrylonitrile (CH_2CHCN) is an industrial chemical used in the manufacture of plastics. It should be possible to use the acrylonitrile emission inventory to trace the source of the formaldehyde plumes.