

EXECUTIVE SUMMARY

- A set of three PTR-MS and aerosol mass spectrometers (AMS) units were deployed between September 5-27, 2006, to make co-located VOC/aerosol observations at the Aldine, Deer Park and Bayland Park air monitoring stations of Houston, Texas. These locations were chosen based on past measurements showing very high ozone design values at these sites and strong contrasts in aerosol composition and hygroscopicity. The Deer Park site, on the southeast part of Houston, is also very close to the emission-rich Houston Ship Channel. The Bayland Park site is on the southwest part of Houston and Aldine in the north-central part of the city.
- The key participants in this campaign were Battelle Northwest (prime contractor to TERC/HARC), Washington State University (under contract to Battelle), and Texas A&M University. Support for two of the scientists who joined us in the field came from funding provided by Pacific Northwest National Laboratory's Environmental Molecular Sciences Laboratory. Our strong interest in trace-gas/aerosol relations also allowed us to bring resources from DOE's Atmospheric Sciences Program (ASP).
- Although this project began with the goal of making measurements from three levels of a skyscraper in western Houston (The Williams Tower), we were directed by HARC to consider an alternative field campaign when liability (and related legal) issues precluded access to this site. The alternative plan, reported here, describes a program based on a horizontal deployment of instruments rather than a vertical deployment.
- Daily reports describing the transition from the Williams Tower campaign to "The Houston Triangle" campaign are included in this report. Also included in this report are daily summaries prepared while we were in the field.
- Two PTR-MS were provided by Pacific Northwest National Laboratory, with the third provided by Texas A&M University. All PTR-MS instruments monitored a total of 25 masses during the campaign. Concentrations of all species are currently being calculated, but here we report preliminary data from the PNNL/WSU instruments at Deer Park and Bayland Park. Statistical summaries of the following four masses are presented: M69--isoprene; M71--Methyl vinyl ketone and mathacrolein (MVK_MACR); M93--toluene; and M107—xylenes. The aromatic compounds (toluene and xylenes) were chosen as characteristic of industrial emissions and gasoline. Isoprene was included to represent a biogenic emission and MVK+MACR was included to show an oxidation product of primary emissions. We have not included our preliminary results for m43-propene and m57-butenes because of a concern about variable background levels identified while doing zeros on the instruments. The mean values and variance of the other species from Deer Park were:

Species	Mass	Mean (ppb)	Variance
Isoprene	m69	0.83	0.33
Methyl vinyl ketone and mathacrolein	m71	0.55	0.12
Toluene	m93	0.49	0.22
Xylenes	m107	0.36	0.08

The mean values and variance from Bayland Park were:

Species	Mass	Mean (ppb)	Variance
Isoprene	m69	0.67	0.27
Methyl vinyl ketone and methacrolein	m71	1.26	0.85
Toluene	m93	0.82	1.14
Xylenes	m107	0.58	0.61

- The uncertainties in comparing the measurements from the Deer Park and Bayland Park PTR-MS are discussed in the text, including species fragmentation for the m43, m57, m69, and m71 masses. Calibration standards for the Bayland and Deer Park instruments were cross compared in the field. Side by side instrument comparisons of ambient measurements, as planned for in the original Williams Tower proposal, could not be executed in the field because of time constraints. Side by side comparisons of ambient measurements would have allowed us to determine differences in fragmentation patterns for the instruments. These differences will be determined post-facto by comparing the PTR-MS data to the canister data. Observations from Aldine will be provided by Texas A&M University under a separate contract.
- An examination of the preliminary PTR-MS data from Bayland Park found no evidence of short timescale plumes associated with point source plumes as observed at LaPorte in TexAQS 2000. The ratio of the species' concentration to toluene is similar to those found in roadway auto exhaust measured in TexAQS 2000. The exception is benzene which is ~40% less abundant relative to toluene. This suggests the gasoline composition in Houston in 2006 has less benzene than in 2000.
- In contrast to aerosol mass spectrometer measurements from other urban areas, a preliminary examination of the AMS data from Deer Park shows events where sulfate acts independently of the other aerosol groups, although there are periods when organic and sulfate species seem to be related. We suspect this feature results from the complexity of emissions from the Ship Channel. That is, this change in correlation will be found to result from relatively small changes in flow patterns from one part of the Ship Channel to another. No clear diurnal pattern has been identified from our first examination of this data set. The period from September 16-18 was cool and rainy, resulting in relatively low mass loadings for all aerosols.
- Twice daily back trajectories starting at the centroid of the Houston Triangle are also presented. Steady northerly flow characterized the period of September 4-8, with more easterly flow (and apparent sea breeze reversals) September 9-13. Northerly flow occurred on September 14 but became easterly/southeasterly September 15-18, and northerly again on the 19th and 20th before becoming southerly September 21-24. During our last week the flow was from the north early in the week (September 25-27) and was generally southerly from September 28 until our departure on September 30.
- An examination by Dr. Bernhard Rappenglueck (University of Houston) and Rainer Schmitt (Metcon Corp.) of the preliminary PAN observations from the Aldine site showed that while PAN and PPN data was relatively low during September 16-18, September 13-15 showed enhanced values. Highest values of about 3.3 ppbv for PAN and 0.6 ppbv for PPN were observed on September 14. These levels are close to the values that had been observed at the Moody Tower up until this date. Usually PPN/PAN ratios are found close to 10%. Observations from this campaign (up until September 14) show PPN/PAN ratios of about 20%, which may indicate some specific precursor contributions for PPN.

- Overall, PAN concentrations were found to be moderate possibly due to the high temperatures (typically above 30°C). This is known to reduce their atmospheric lifetimes even though production rates may be considerable.
- A preliminary examination of the PTR-MS data from the Aldine site by Dr. Jun Zheng (Texas A&M University) found at least three interesting periods of VOC observations. One noticeable “event” (from September 15-17) was from the time series of m43 (nominally propene + fragments) and m45 (acetaldehyde) which were highly correlated. Since acetaldehyde is predominately formed through OH oxidation of propene, it is likely that m43 was indeed propene.