

AQRP Monthly Technical Report

PROJECT TITLE	Hydrogen Cyanide for Improved Identification of Fire Plumes in the (BC)² Network	PROJECT #	22-006
PROJECT PARTICIPANTS	Dr. Tara I. Yacovitch, PI Dr. Rebecca Sheesley and Dr. Sascha Usenko, Co-PIs	DATE SUBMITTED	11/10/2022
REPORTING PERIOD	From: 10/1/2022 To: 10/31/2022	REPORT #	3

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task for reporting period

The project team continues to hold regular project meetings in the lead up to the campaign.

The HCN instrument's performance at Aerodyne Research, Inc. offices was deemed acceptable, so the instrument and auxiliary equipment was packed in a crate and ground shipped to Baylor University. Aerodyne Scientist Conner Daube then flew to Baylor to assist with the physical integration of the instrument into a (BC)² network trailer that is powered and set up at Baylor University. While there, he was assisted by 2 Baylor graduate students in Dr. Usenko's group, who participated in the integration and received training on the instrument's operation, maintenance, and troubleshooting.

The HCN instrument performed well upon turn-on (<30 ppt 1-second noise), but suffered a detector problem resulting in a performance degradation (~130 ppt 1-second noise) after the instrument was moved a relatively short-distance into its final vibration-damping mount. Aerodyne Research, Inc. engineers provided remote troubleshooting assistance, and the issue was traced back to the high-gain setting of the infrared detector. We have a plan to replace this component prior to deployment at DFW (described below), but have chosen to leave the old detector installed in the instrument so that we can operate the instrument while at Baylor, collect some test data, and watch for any additional problems that arise. At this time, the instrument is running, and Baylor graduate students are communicating closely with Aerodyne on its operation. The instrument is also connected to the internet, enabling remote access, and allowing the instrument computer to send out email status reports and/or interlock/crisis emails to Aerodyne project personnel.

Site planning is continuing through the BC² network program, led by Sascha Usenko, and in coordination with Doug Boyer (TCEQ, for the (BC)² network project) and Vince Torres (TX AQRP, for this HCN project and the related AQRP project 22-010, PI: Ed Fortner). The two candidate sites are the Arlington Municipal Airport site (in between Dallas and Fort-Worth, near

I-20) and the Meacham Airport (Fort Worth Northwest site). Both sites require electrical upgrades to host an additional (BC)² trailer. An electrician comfortable working with the state and with airports has been identified, and the electrical needs have been specified. Currently, the plan will be to deploy the trailer with HCN sensor to the first site that is ready to host it.

Preliminary Analysis

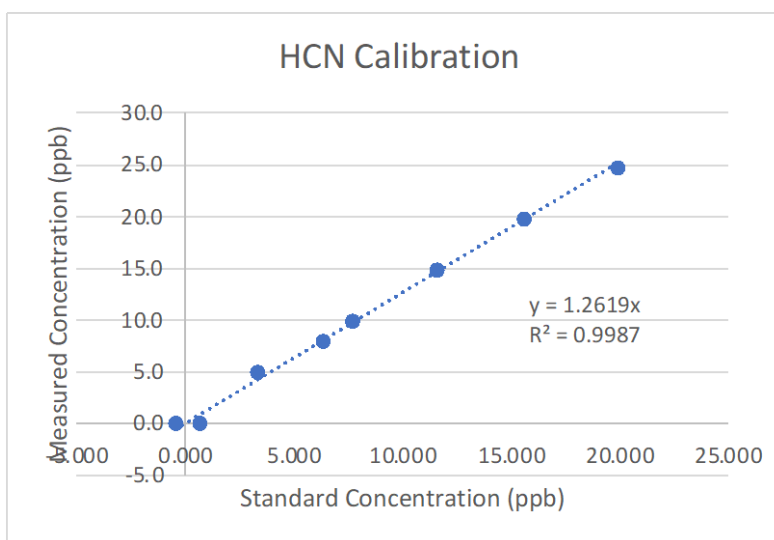
During the instrument integration, a first calibration of the HCN sensor was done using a 5 ppm commercial calibration tank. The calibration factor is $m=1.26$ where $\text{True} = m * \text{Raw}$. Linearity is excellent. For comparison, calibration factors for this same HCN spectral line, in a different instrument chassis and using a different calibration tank from the same vendor, was $\text{True} = 1.01 * \text{Raw}$. At this stage, we attribute the difference in calibration factors to uncertainties in the tanks. The FIREX tank was a “GasCo” tank; this project’s tank was also a GasCo tank, but purchased through a local reseller called “Calibration Controls”. More detail is being requested of the seller to better understand the uncertainty in the specified tank concentrations.

10/26/22

5 ppm HCN in N2 balance

HCN calibration #1 (at Baylor U.) - 1 PM local (6PM UTC)

<i>HCN (ppb)</i>	<i>UZA (sccm)</i>	<i>HCN (sccm)</i>	<i>Meas. (ppb)</i>	<i>Calc. (ppb)</i>
5000	5050	0	-0.460	0.0
5000	5050	10	7.69	9.9
5000	5050	20	15.6	19.8
5000	5050	5	3.29	5.0
5000	5050	15	11.6	14.9
5000	5050	25	19.9	24.8
5000	5050	8	6.34	7.9
5000	5050	0	0.631	0.0



Data Collected

Ambient data indoors and from Aerodyne's rooftop has been collected. Ambient data at Baylor University is also being collected. This data is not part of the project deliverables, but can be used for instrument testing and quality assurance.

Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments

The detector issue encountered during integration is a concern. The degradation of instrument performance pushed the instrument outside of specifications as outlined in the QAPP, and so we have decided that Conner Daube will travel back to Baylor with a drop-in replacement detector. We have some flexibility on the timing of this visit, and so will attempt to schedule it to coincide with the planned deployment of the trailer to the DFW field site, for additional troubleshooting of any issues related to the move or to power at the site.

Such an emergency visit was planned for in the project budget; should emergency maintenance be required during the Spring campaign, it will not require a dedicated trip due to the presence of Aerodyne personnel in the area as part of the mobile lab project 22-010.

Progress on site access and power is progressing but is also a concern, since we now know that both candidate sites require electrical upgrades. We are mitigating its effects on campaign timing by integrating the instrument into the (BC)² trailer at Baylor U, so that the trailer can be fully functional as soon as possible. The HCN sensor is currently operating in the trailer.

Goals and Anticipated Issues for the Succeeding Reporting Period

Site power upgrades are expected in the next reporting period, and the trailer is therefore expected to be deployed to Dallas-Fort-Worth at that point. The HCN instrument detector replacement is also expected to occur in the next project period.

Detailed Analysis of the Progress of the Task Order to Date

Project progress continues, with significant progress made on both the instrument integration and site access fronts.

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

Yes No

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

Yes No

Do you have any bibliographic publications (ie: publications that cite the project) related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

Yes No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).

Yes No

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

Yes No

Have any personnel changes occurred that were not listed in the original proposal? If so, please include a detailed description of the personnel change(s) below.

Yes No

As described in the Workplan documents, and discussed directly with AQRP project management, Dr. Yacovitch will be on family leave beginning mid-December for approximately 4 months, with Conner Daube to take over project management and reporting during her absence. He is already heavily involved in the project.

Are any delays expected in the progress of the research? If so, please include a detailed description of the potential delay below.

Yes No

Describe any possible concerns/issues (technical or non-technical) that AQRP should be made aware of.

Are you anticipating using all the available funds allocated to this project by the end date? If not, why and approximately what is the amount to be returned?

Yes No

Submitted to AQRP by

Dr. Tara Yacovitch, PI