

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	10/10/2022
REPORTING PERIOD	From: 9/1/2022 To: 9/30/2022	REPORT #	2

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.

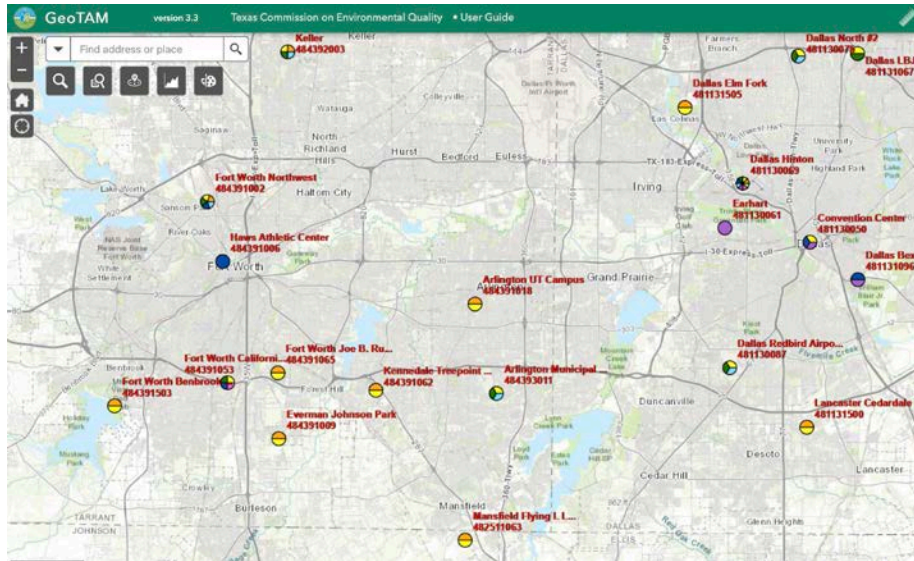
Detailed Accomplishments by Task for reporting period

We did not receive approval of the QAPP until 9/20/2022 from TCEQ.

We held project meetings. Aerodyne and Baylor U. are meeting every 2 weeks to discuss the project, integration, and the campaign.

The instrument was setup at Aerodyne, and the HCN laser was installed into the pre-existing chassis. The laser was pulled from inventory, put into a housing, setup and aligned in the instrument. The laser has adequate light levels, and is showing very good performance (see “analysis section” below. During this setup, we have found that in addition to CO₂, most people have HCN in their breath (see for example Dummer *et al.* 2013, DOI: 10.1088/1752-7155/7/1/017105). This turns out to be a convenient data quality indicator during setup, as the presence of HCN and CO₂ from breath can be used to fine-tune the laser tuning rate. The instrument was left sampling from a roof inlet, where ambient HCN in Massachusetts can be measured, and traffic interferences from cars in the parking lot can be assessed, as we prepare other equipment for shipment. Long-lead time consumables (calibration gas, chiller fluid) have been ordered and arrived at Baylor U.

Site negotiations are continuing through the BC² network program, led by Sascha Usenko, and in coordination with Doug Boyer (TCEQ, for the BC² network project) and Vince Torres (TX AQRP, for this HCN project and the related AQRP project 22-010, PI: Ed Fortner). As part of the BC² network project, Dr. Usenko is pursuing multiple site options in the Dallas-Fort-Worth Area. Currently, the Arlington Municipal Airport site (in between Dallas and Fort-Worth, near I-20) is looking like a promising location in terms of the fall HCN campaign for both permissions and power. The Meacham Airport (Fort Worth Northwest site) is another candidate site being pursued. A map from TCEQ’s GeoTAM website shows both sites, below.

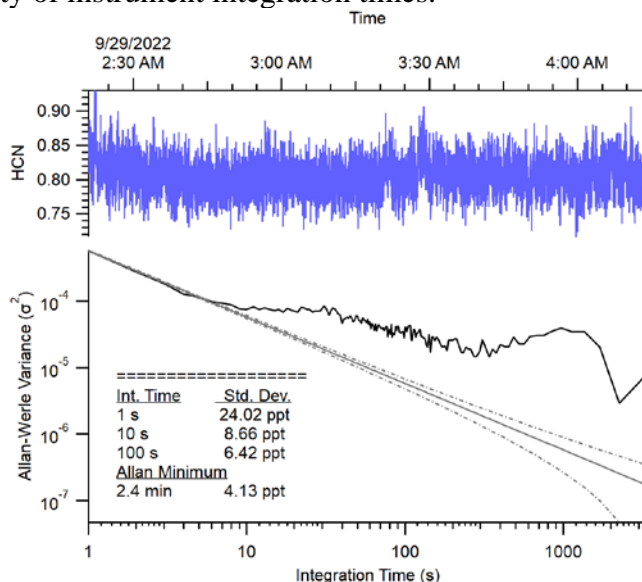


Preliminary Analysis

The screengrab below shows a zoom-in on the HCN region of the absorption spectrum sampling directly from human breath. A central HCN peak is clearly visible (10.8 ppb), with two weak CO₂ lines on either side. The HCN absorption and fit look excellent. The CO₂ lines are weak, and are only appropriate for qualitative measurement of very strong concentrations (not ambient or traffic data), but they provide further spectral fingerprinting of the region. The presence of HCN and CO₂ in human breath allows fine tuning of the peak positions of the fit (blue lines) vs the measurement (green data) via the tuning rate. The presence of HCN in breath is not a concern for ambient sampling, as the inlet will be on the top of the trailer, and people will not be breathing directly into it.



The performance of the HCN monitor at Aerodyne is excellent. With a 1-second noise of 24 ppt (1-sigma), the instrument performance is well within the 80 ppt 1-sigma 1-second noise threshold listed in the QAPP. The graph below is an Allan-Werle plot showing the 1-sigma noise performance at a variety of instrument integration times.



Data Collected

Ambient data indoors and from Aerodyne’s rooftop has been collected. This data is not part of the project deliverables, but can be used for instrument testing and quality assurance, as shown in the above Allan-Werle plot.

Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments

Progress on contracting continues to be a concern, as we did not receive TCEQ QAPP approval until 9/20/2022 and are waiting for the contract. After Sept 30th, the end of our fiscal year, Aerodyne is able to open a “virtual” account, which will allow full project charging (including labor) in without restrictions in advance of contracting.

Progress on site access and power is also a concern. We plan to mitigate the effects on campaign timing by integrating the instrument into the BC2 trailer at Baylor U, so that all the instrument will be operational in Texas as soon as possible, and the whole integrated trailer needs only to be towed to the site in question and powered up.

Goals and Anticipated Issues for the Succeeding Reporting Period

Site negotiations will continue, led by Dr. Usenko, and supported by the AQRP and TCEQ. These conversations will focus on siting, and any power upgrades required.

In October, we plan to ship the HCN instrument to Baylor U. where it will be integrated into the BC² trailer. In late October, Conner Daube will schedule travel to Baylor U. to assist with final integration, perform any required alignment after shipment, and train Baylor U. grad student(s) on instrument-turn-on, maintenance, and shutdown.

Detailed Analysis of the Progress of the Task Order to Date

The project is continuing, despite contracting delays, with a focus on instrument readiness and site access.

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