

AQRP Monthly Technical Report

PROJECT TITLE	Improving Emission Rates Estimates of Commercial Marine Vessels	PROJECT #	24-003
PROJECT PARTICIPANTS	University of Houston, Ramboll, FluxSense	DATE SUBMITTED	07/10/2025
REPORTING PERIOD	From: 06/01/2025 To: 06/30/2025	REPORT #	11

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

- Upon spot check of nitric oxide (NO) and nitrogen dioxide (NO₂) against carbon dioxide (CO₂) plume time series plots, it was observed that NO₂ peaks do not align well with others. This leads to realignment of the NO₂ plume peak times. More details are discussed below.
- Developed a program to analyze valid plumes from all plume data for analysis (peak time +/- 50 seconds), gap fill short time windows (up to 3 seconds) with missing data using linear interpolation, and estimate emission ratios between pollutants (e.g., Nitrogen Oxides (NO_x)) and CO₂.
- Developed a template for the Draft Final Report.
- Began working on the Draft Final Report.
- Had a discussion between Ramboll and the University of Houston (UH) regarding plume identifications and plans for developing final reports.

Preliminary Analysis

- Figure 1 below is an example time series of a plume, showing NO_x (parts per billion by volume (ppbv)) and CO₂ (parts per million by volume (ppmv)) on the y-axis, and seconds from peak time on the x-axis, using the plume data after NO₂ re-alignment. NO_x and CO₂ peaks align well, and +/- 50-second time window is enough to capture the plume.

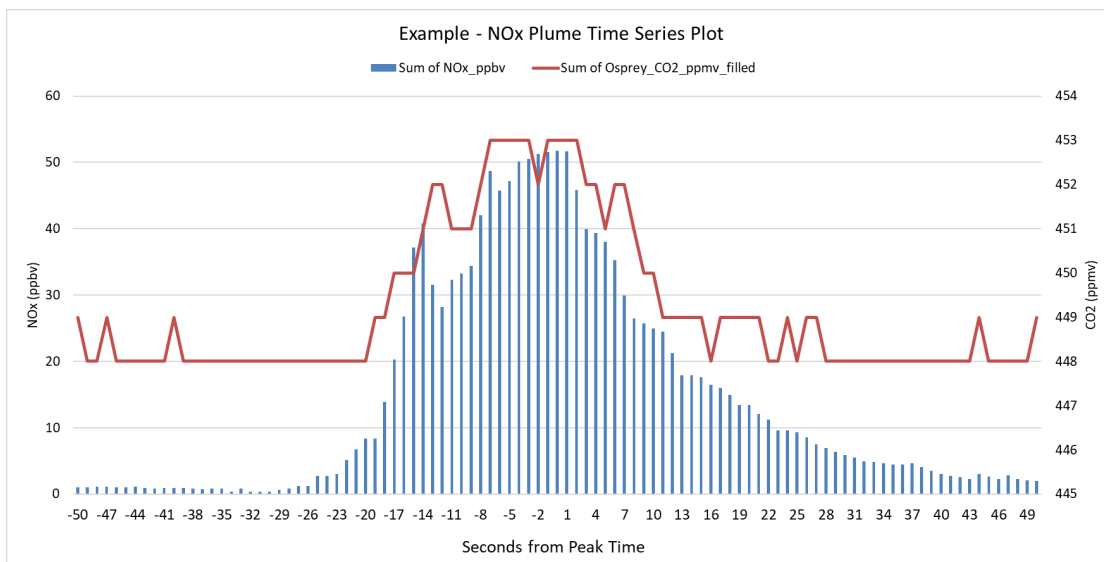


Figure 1: Sample NO_x and CO₂ plume time series plot.

Data Collected

Yes

Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments

- The peak alignment for the NO₂ instrument was challenging and aligning some peaks caused others to be poorly aligned. The instrument used on this project is a Teledyne T500U, which is a direct optical NO₂ measurement. Peak alignments were conducted by aligning sharp peaks in trace gases to those in the CO₂ data, given that the CO₂ was the fastest responding instrument. Spot checks of other major peaks showed relatively good alignment between NO₂ and CO₂. During their analysis, Ramboll identified that most of the smaller peaks were misaligned, as much as 15–20 seconds. It was determined that this is likely due to the degree of signal processing applied in the instrument and the adaptive filtering approach they use. When strong gradients are detected, the sample filter size shrinks to resolve strong plumes and then reverts to a longer sample smoothing for other periods. UH has worked with Teledyne to attempt to shrink the sample size to the minimum for all measurements. However, it appears that changing the values does not actually change instrument performance and the values may be hardcoded into the firmware and not linked to the instrument controls in some cases. The resolution to this was to visually inspect and shift all of the nearly 400 identified plumes individually. UH will continue to work with Teledyne on a solution to this issue, as it impacts other Teledyne instruments to varying degrees.

Goals and Anticipated Issues for the Succeeding Reporting Period

- Continue with the plume analysis and emission rates comparison.
- Tabulate the results relative to the expected emissions values with regression uncertainties.
- Complete draft final report by July 25th to allow principal investigators time to review it before submission.

Detailed Analysis of the Progress of the Task Order to Date

None

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

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.

N/A

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
James Flynn