1. Background

- Peroxy acetyl nitrate (PAN: CH₃C(O)(NO₂)) and related compounds are photochemically produced tropospheric pollutants.
- They can be used to identify the volatile organic compounds (VOCs) driving local photochemistry.¹ ² ³ They serve as a reservoir for NOₓ.³
- Carlsbad Caverns currently has episodic periods of elevated oxygen mixing ratio, posing a concern for the ecosystem and public health.
- It is hypothesized that nearby oil and gas extraction may be contributing to the formation of ozone.
- A gas chromatograph instrument (GC) with an electron capture detector (ECD) has been deployed to Carlsbad Caverns National Park to measure PANs.

2. The System

- The carrier (He) and dopant (N₂) gases are purified and pass through needle valves for flow control.
- The helium is hydrated by passing through Cu(II) SO₄ - 6H₂O, which minimizes the loss of PAN on the tubing.
- A 6-port valve allows the sample to fill a sampling loop and then be injected into the column and ECD.
- A capillary column separates the compounds.
- Inside the ECD, radioactive ⁶⁰Ni emits a stream of electrons. When electronegative species such as oxygen and PAN pass through the stream, they absorb some of these electrons. This provides a signal.

3. Instrument Design

- PAN is produced in a photolysis chamber by oxidizing acetone in the presence of NO.
- The GC instrument is calibrated by sending known amounts of PAN from the calibrator to the instrument, and measuring the peak areas for each known amount to make a calibration curve.

4. Calibration

- Fort Collins air was measured over several days to ensure that the instrument was working properly.
- The following figure displays the diurnal cycle of PAN, and also shows an expected sequence of peak areas over a 24-hour period.

5. Preliminary Data

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- References