# Identification of Vehicle-related VOCs Indices with PMF-resolved Data from PAMS in Taiwan

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## Abstract

- **Introduction**
  - Immediate examination of vehicle-related emissions
  - Combining traffic volume and PAMS data is necessary
  - Control strategies of VOCs of vehicle-related emissions
- **Objectives**
  - Use PAMS hourly monitoring data to identify potential vehicle indices
  - Clarify contribution of vehicle-related emissions to observed PAMS data
  - Verification of existed research of vehicle indices in Taiwan
- **Method**
  - Sampling site: Tucheng and Zhongming PAMS (**Fig 1.**)
  - Comparing PAMS monitoring and PMF-resolved (vehicle) data to identify potential vehicle indices
  - Utilizing vehicle detector (VD) data for verification of index representativeness
- **Results and Discussion**
  - Common indices were identified as vehicle indices in both sites, while different indices were chosen as regional vehicle indices in individual site respectively.
  - Inconsistency of vehicle indices and VD was observed, and it may be attributed to meteorological factors or transportation of pollutants.

## Methods

- **Data:** Tucheng and Zhongming PAMS (53 VOCs) in 2013
- **Positive Matrix Factorization (Receptor modeling)**

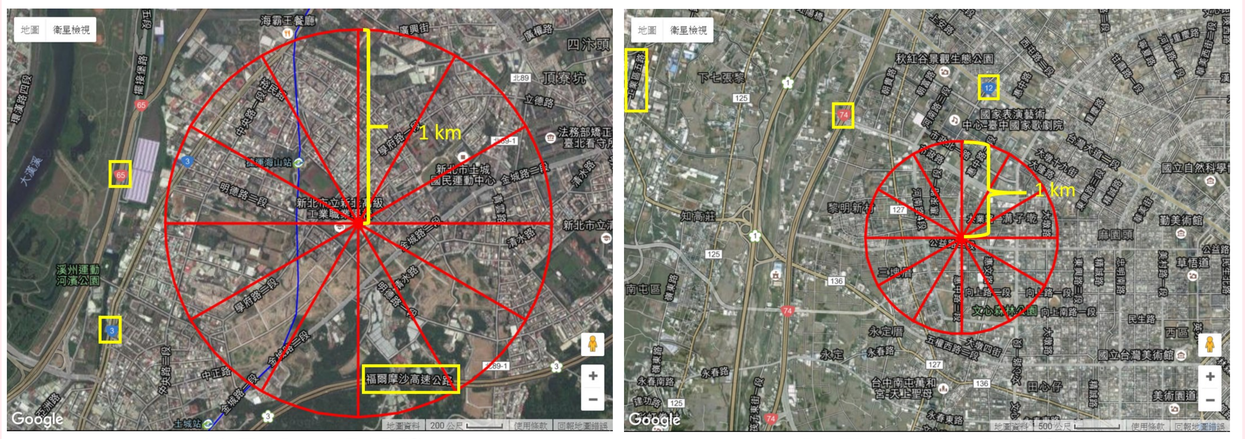
Measurements / Contributions / Mass fraction / Residuals

$$X_{ij} = \sum_{k=1}^{p} g_{ik} f_{kj} + e_{ij}$$

- **Index selection criteria (Fig 3.)**
  - Species stably emitted with constant ratio
  - Species mostly contributed by vehicle (**averaged vehicle contribution > 50%** )
  - Species reflecting the impact of emission activity from vehicle (**$R^2$ of correlation between vehicle-contributed and monitoring data >0.5** )

## Results and Discussion

- **Descriptive Analysis (Fig2.)**
  - Not all species were contributed mostly by vehicle, so vehicle-contributed mass should be retrieved.
- **Selected Vehicle Indices**
  - **Common Vehicle Indices:** 2,2,4-trimethylpentane (224-TMP), 2,3,4-trimethylpentane (234-TMP), 2-Methylheptane (2-MH), 3-Methylheptane (3-MH)
  - **Site-specific Vehicle Indices** such as Pentene (Tucheng), Ethyltoluene (Zhongming) was chosen may be due to less emission from non-vehicle sources.
- **Comparing with VD data (2,3,4-TMP as vehicle index) (Fig 4./5.)**
  - Temporal inconsistency (**diurnal** and **monthly**) of vehicle indices and VD was attributed to meteorological factors or transportation of pollutants.




(a) Tucheng PAMS (b) Zhongming PAMS

*Fig 1. Satellite map of PAMS's neighboring area*

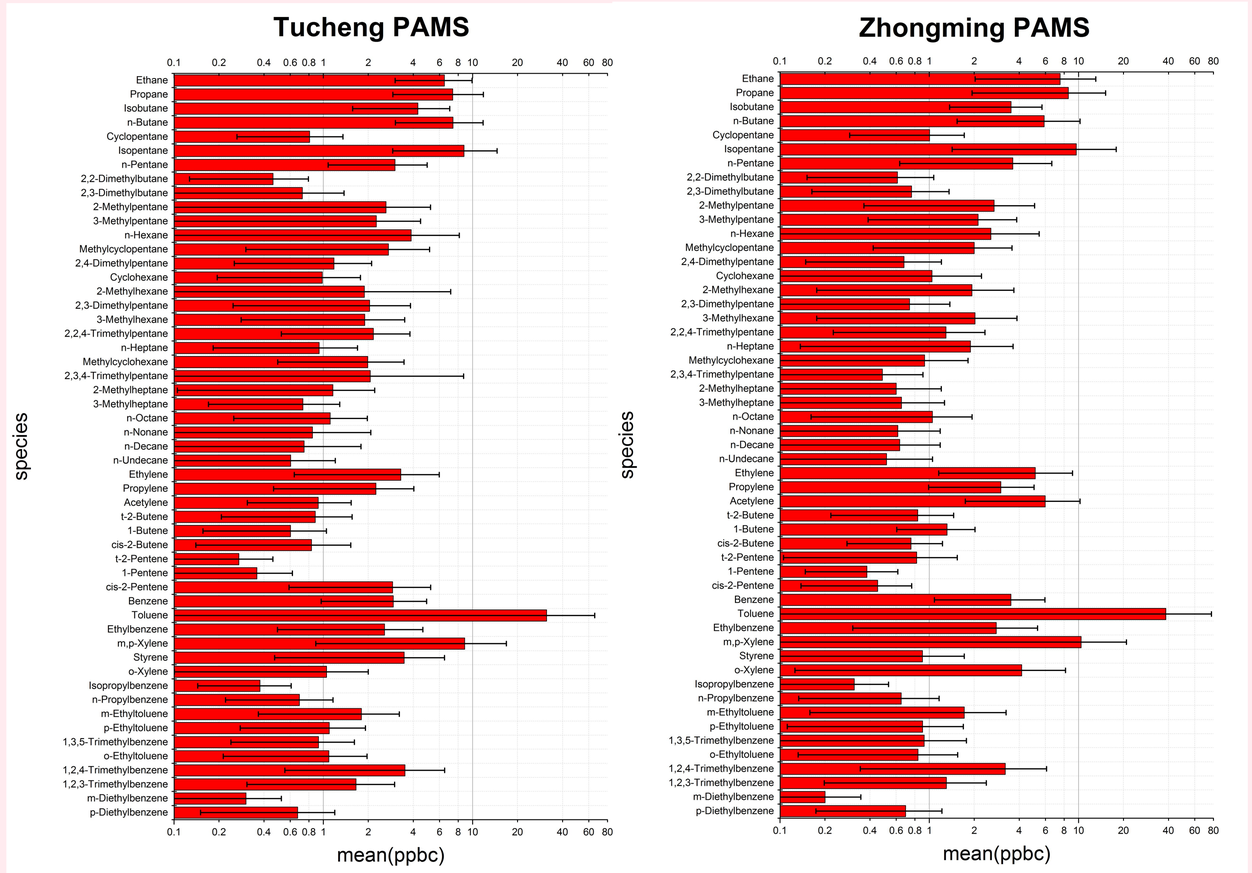



*Fig 2. Annual mean concentration of PAMS monitoring 53 species*

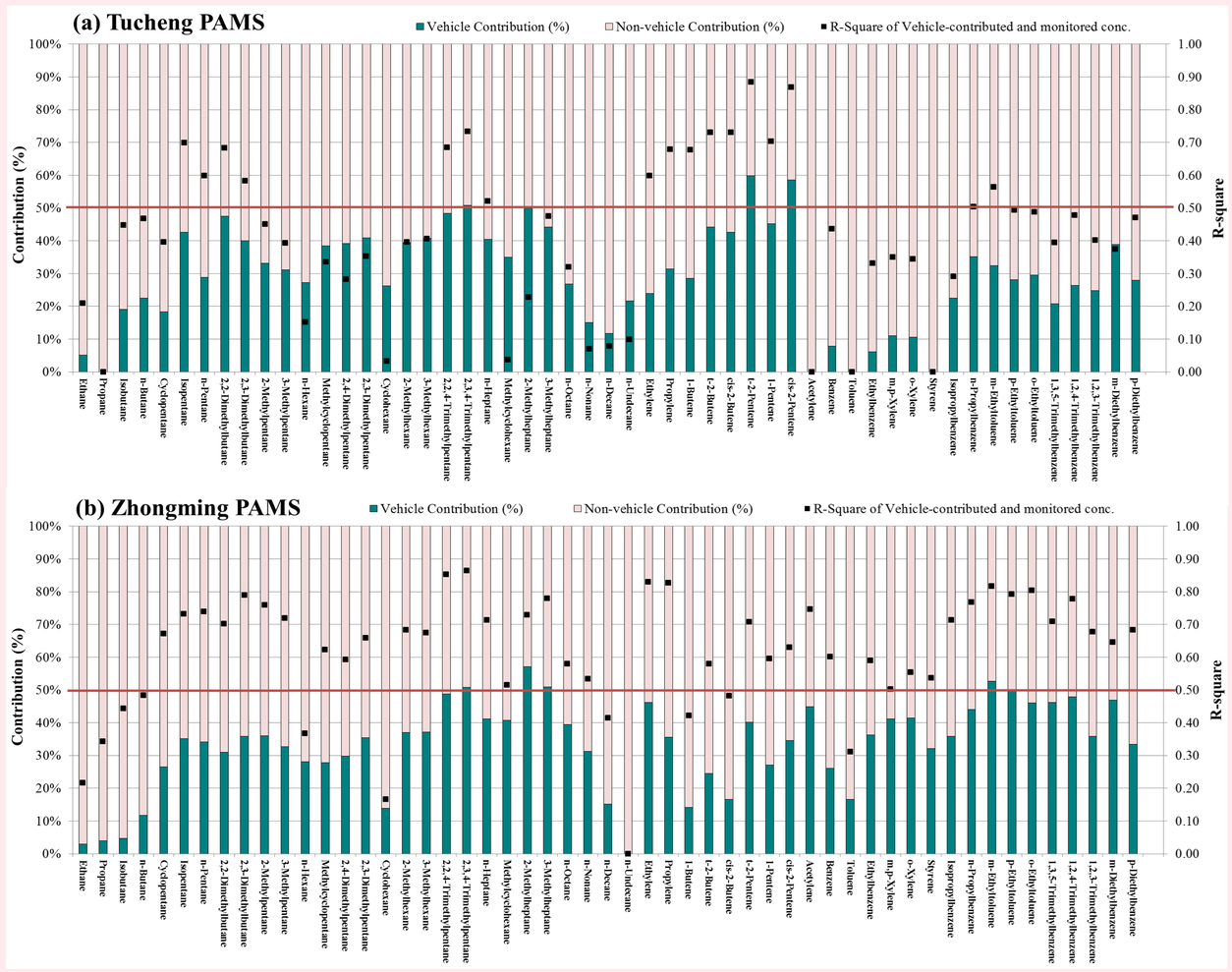



*Fig 3. Averaged vehicle contribution and R-square of vehicle-contributed and monitored concentration at both sites*

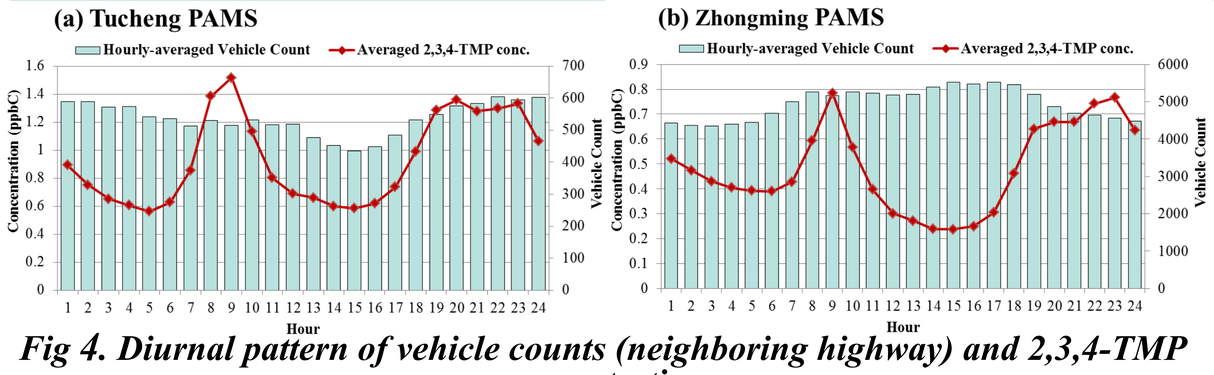



*Fig 4. Diurnal pattern of vehicle counts (neighboring highway) and 2,3,4-TMP concentration*

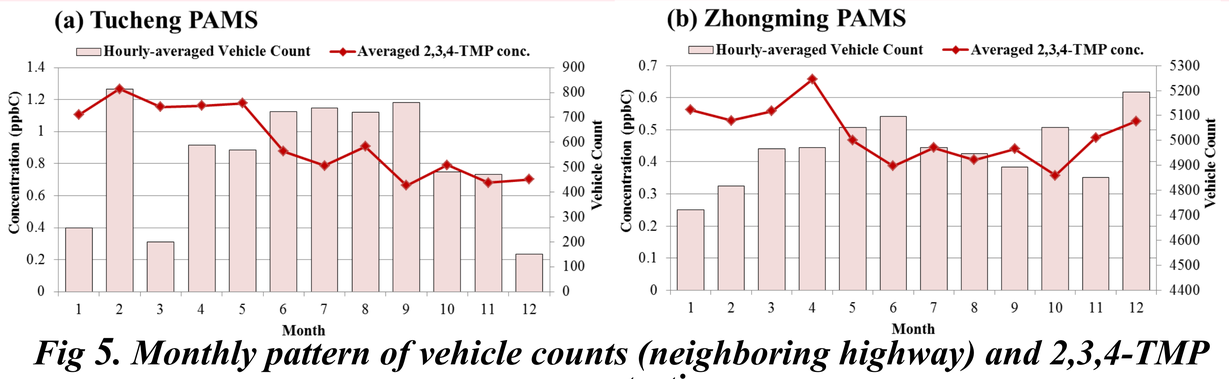



*Fig 5. Monthly pattern of vehicle counts (neighboring highway) and 2,3,4-TMP concentration*