# Complementary Field Online Monitoring of PAMS and HAP VOCs at Petrochemical Complexes

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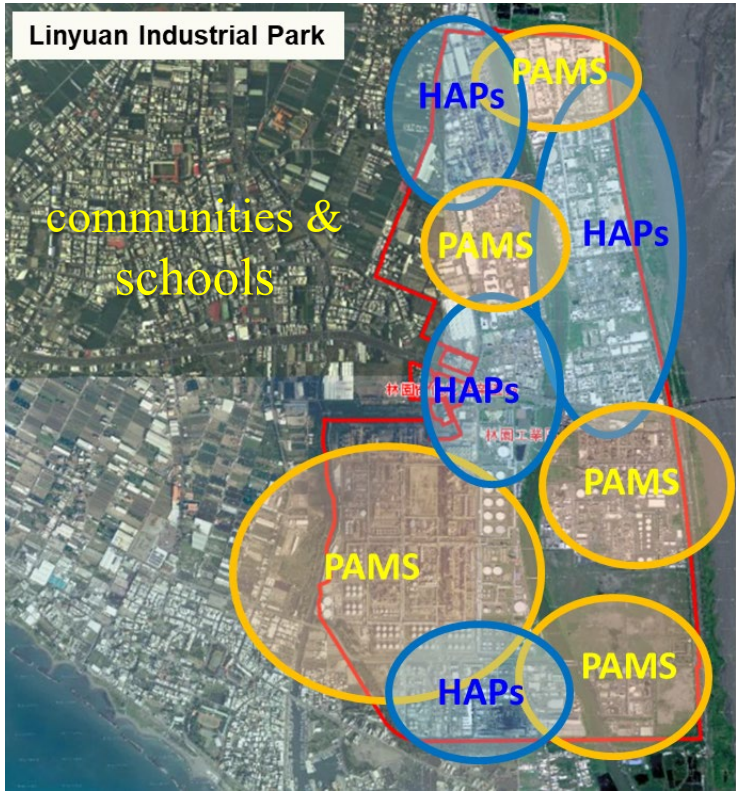
# Background of the Studied Field

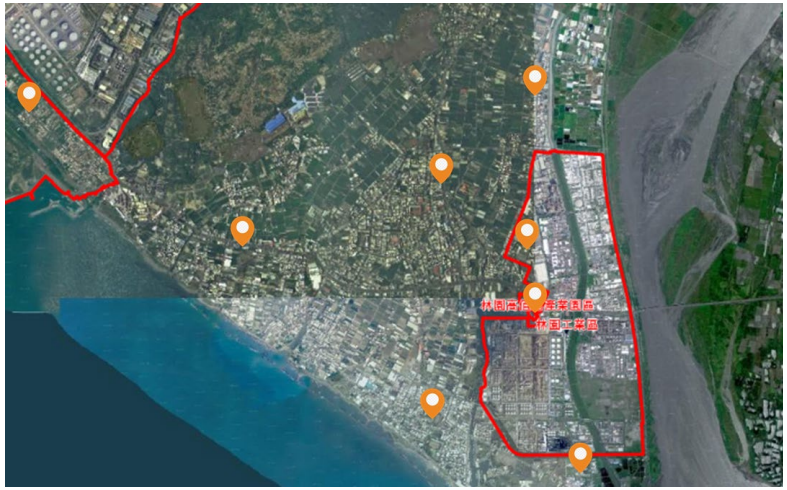
- The industrial complex (Linyuan Industrial Park, Taiwan) for this study contains petrochemical plants, oil refinery, chemical manufactures, and etc.
- Both PAMS VOCs and HAPs (Air Toxic) are identified in this area




**Emission of both PAMS VOCs & HAPs are identified in the studied field**

| VOC Category | Monitoring Method |
|---|---|
| PAMS | Online auto GC-FID |
| HAPs | Offline GC-MS (TO-15) |

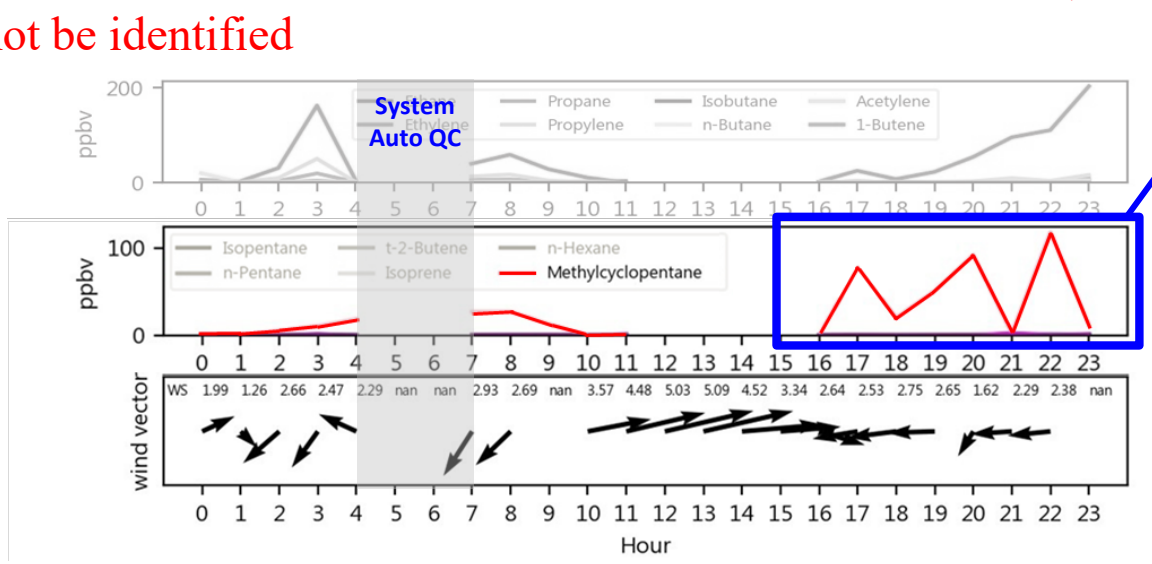
**Current compliance VOC monitoring programs under Taiwan EPA**



**Locations of PAMS stations**

# Issue: Emission Source of a Monitored PAMS VOC cannot be identified

- Advanced source tracking method* is utilized by Taiwan EPA to identify emission sources of high-concentration episodes and to communicate with corresponding facility owners for emission reduction
- Recently found that the emission source of a monitored PAMS VOC, Methylcyclopentane (MCP), cannot be identified




**2022/7/26 Linyuan Industrial Park**

* C-L Tai, *et al.*, "Advanced Online Monitoring Management of NGEM Automatic Field-GC for HAPs Source Tracking and Emission Reduction at Industrial Complexes", *Proceedings of the 2022 AWMA, Air Quality Measurement Methods and Technology Conference*, 2022.

# Laboratory Study to Verify the Issue

- **Method**: PAMS auto GC-FID is challenged by **TO-15** standard gases
- 5 PAMS VOCs are identified having potential co-elution with HAP VOCs
- Methylcyclopentane (MCP) might coelute with 1,2-Dichloroethane (EDC) in PAMS auto GC-FID

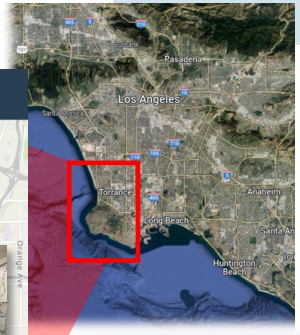
| PAMS VOC | | HAP VOC (potential co-elution with PAMS VOC) | |
|---|---|---|---|
| **Species** | **RI*** | **Species** | **RI*** |
| 2,3-Dimethylbutane | 563 | Vinyl acetate | 560 |
| Methylcyclopentane | 627 | 1,2-Dichloroethane | 627 |
| 2,2,4-Trimethylpentane | 691 | Trichloroethylene | 691 |
| o-Xylene | 887 | 1,1,2,2-Tetrachloroethane | 886 |
| o-Ethyltoluene | 975 | α-Methylstyrene | 972 |

* Retention Indices (RI) is an index to standardize the retention time of each column

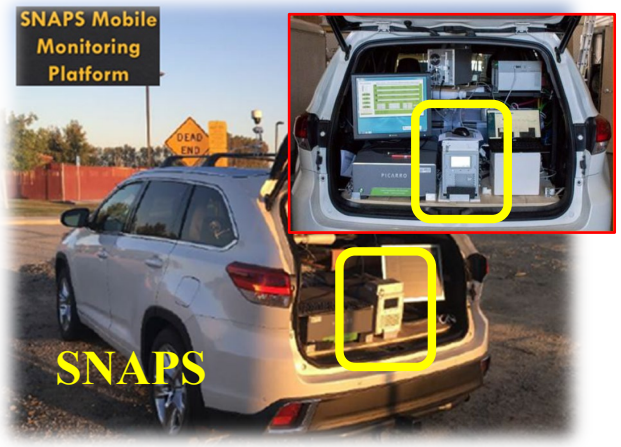
# Online HAP Monitoring Tool for Field Validation

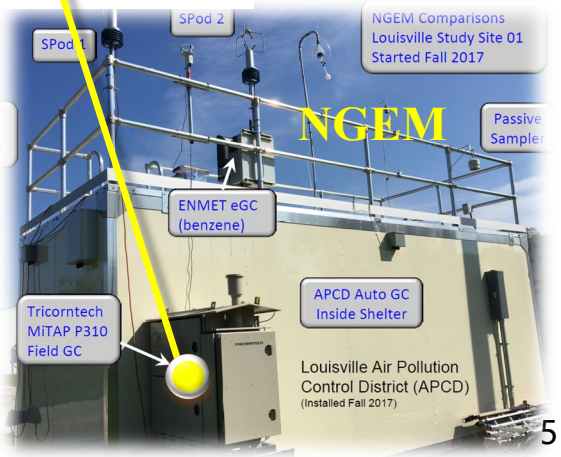
- **Field Auto-GC, MiTAP,** is co-located with PAMS GC-FID
- **MiTAPs** have been implemented in
  - SCAQMD Rule 1180 & AB617 for compliance monitoring
  - CARB SNAPS for source tracking
  - US EPA ORD for NGEM

| Alkenes | Aromatics | Chlorinated VOCs | |
|---|---|---|---|
| Propene | Benzene | Vinyl Chloride (VCM) | Trichloroethylene |
| 1,3-Butadiene | Toluene | 1,2-Dichloroethane (EDC) | Perchloroethylene |
| | Ethylbenzene | Trichloromethane (CF) | 1,2-Dichlorobenzene |
| | Xylenes | Carbon tetrachloride | 1,4-Dichlorobenzene |
| | Styrene | Methylene chloride (DCM) | |





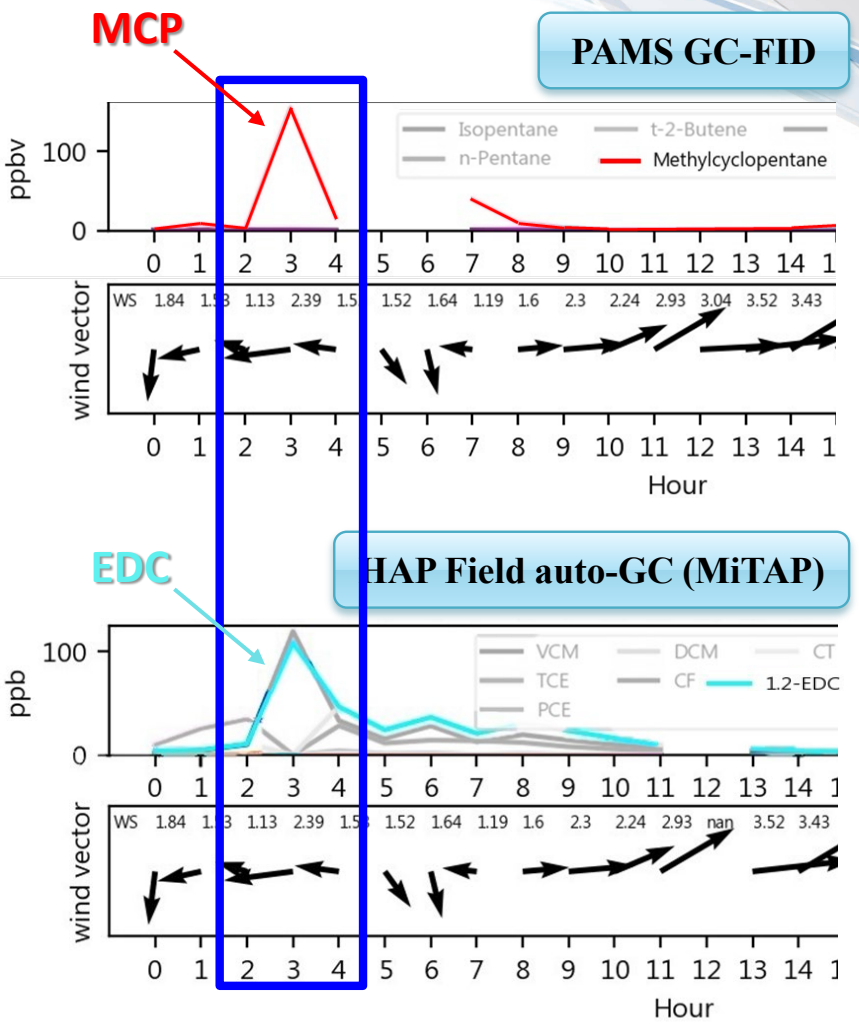



# Results from the Field Validation

- During the co-location period, the high-concentration episode was observed
  - ➢ EDC reported by HAP field auto-GC (MiTAP)
  - ➢ MCP reported by PAMS GC-FID
- Triggered canister grab sample was analyzed by laboratory GC-MS, confirming the presence of EDC instead of MCP

| Monitoring Method | Concentration(ppb) | |
|---|---|---|
| | EDC | MCP |
| HAP Field Auto-GC (MiTAP) | 108.9 | - |
| PAMS GC-FID | - | 154.71 |
| Offline GC-MS (canister grab sample) | 179.53 | N.D. |

**2021/04/28 Linyuan Industrial Park**



# Summary

- Both PAMS and HAP VOCs are present at the industrial complex (Linyuan Industrial Park, Taiwan) leading field online VOC monitoring challenging due to potential co-elution between PAMS and HAP VOCs
- 5 PAMS VOCs monitored by auto GC-FID could be potentially interfered by HAP VOCs
- HAP 1,2-Dichloroethane (EDC) is confirmed being mis-reported by PAMS auto GC-FID as Methylcyclopentane (MCP)
- As continuing efforts in campaigning the VOC emission reduction, TW EPA is working on implementation of online HAP VOC monitoring in complementary to the PAMS monitoring in the industrial complex area