An On-Site Continuous Gas Sensing Network for Complex VOCs Monitoring at Industrial Park

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Abstract

- An on-site continuous gas analysis network setup with multiple complex VOCs analyzers and anemometers is proposed and implemented for pollutants detection and location identification.
- The proposed continuous complex VOC analysis network can be used to capture the ambient VOCs abnormity and to further determine the geographical location of pollutants.
- The method provides a feasible solution to earlier VOC leakage detection and location identification of pollution source.

Method and Result

- The VOCs monitoring network was operated for more than three months continuously inside an industrial park in Taiwan.
- US EPA REal TIme GeOspatial viewer (RETIGO) program is used to study the fugitive VOCs concentrations observed by each station in the VOC monitoring network.
- VOC concentrations at Stations A and B (e.g., ~ 5ppbv for toluene) near the production facilities are lower than Station C (e.g., > 30ppbv for toluene), which is farther away from the production facilities.
- VOC concentration at both Stations A and B show periodic fluctuation cycle (Toluene<1ppbv to ~10ppbv) during the daytime which is closely correlated to the normal industrial production activity.
- VOC concentration at Station C is significantly higher without any correlation to the results from Stations A and B.
- Wind field result(Figure 3) indicates that the wind direction is mainly from southwest at Station C towards Station B and Station A.
- High VOC concentration observed at Station C can be determined as source from southwest area outside the monitoring network.

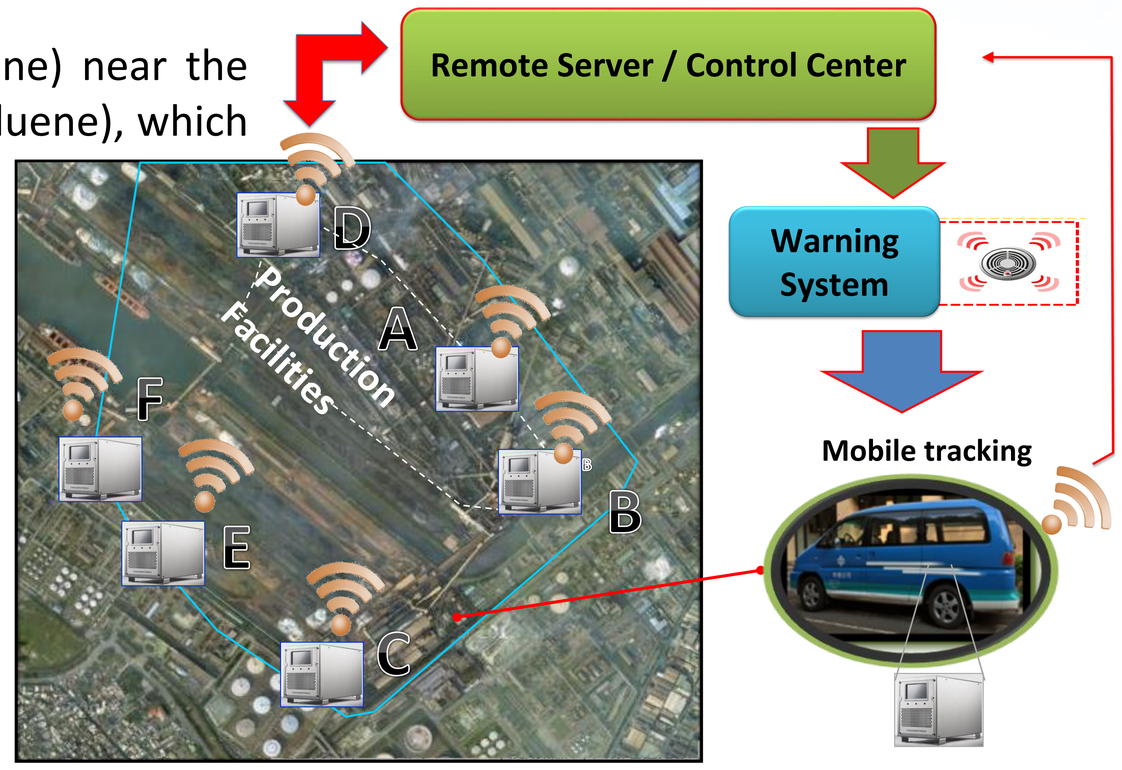

Figure 1. Illustration of remote server / control center used in the on-site continuous VOC analysis network for mobile tracking and response at Industrial Park.

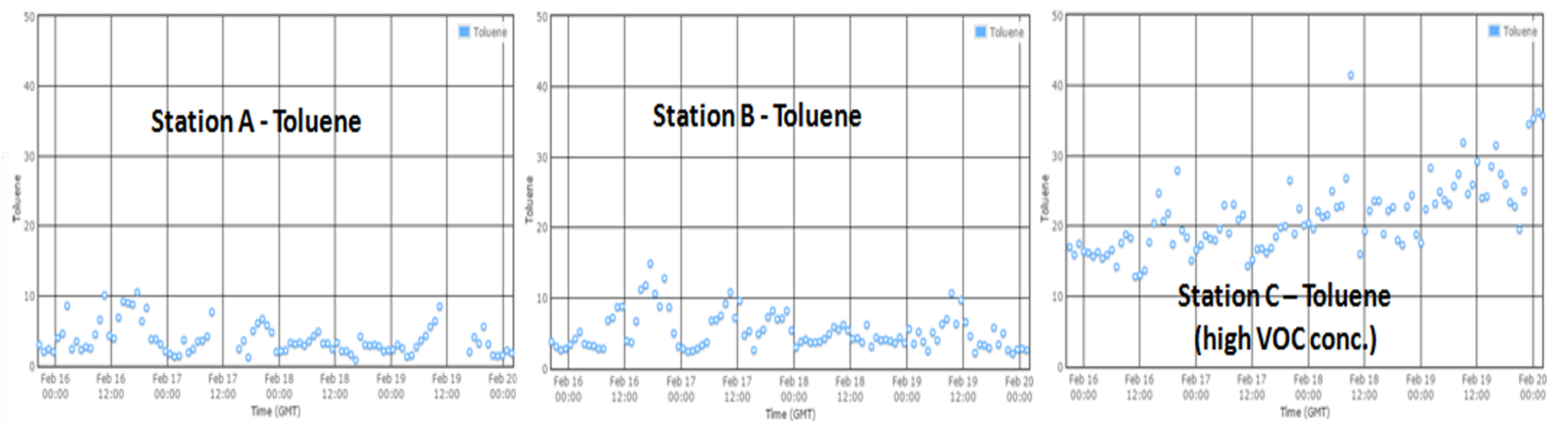

Figure 2. Illustration of toluene concentration trend observed by on-site monitoring stations using US EPA RETIGO program. Toluene at Station C is higher and not correlated to production activities, indicating that the VOC source is from outside the region.

Table 1. Example of VOC concentration statistics monitored by MiTAP-C500 at various stations during continuous on-site analysis. Unit in ppbv.

		Acetone	2-Butanone	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Styrene
Station A	MAX	116.5	31.4	14.9	41.6	23.8	28.1	14.1	24.9
	MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Average	5.9	1.5	1.8	4.5	1.3	0.9	1.0	1.0
	Medium	4.2	0.8	0.8	3.6	0.3	0.0	0.5	0.6
Station B	MAX	223.0	101.3	14.7	158.0	14.2	39.2	14.4	5.8
	MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	Average	9.7	2.8	2.8	6.4	0.5	0.8	0.5	0.9
	Medium	6.0	1.4	1.8	4.1	0.0	0.0	0.2	0.7
Station C	MAX	163.1	61.2	47.5	434.2	156.1	133.6	89.5	124.0
	MIN	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Average	15.0	5.1	4.7	31.9	16.9	15.2	13.5	16.6
	Medium	10.9	2.9	1.0	27.1	12.4	10.7	9.7	7.5

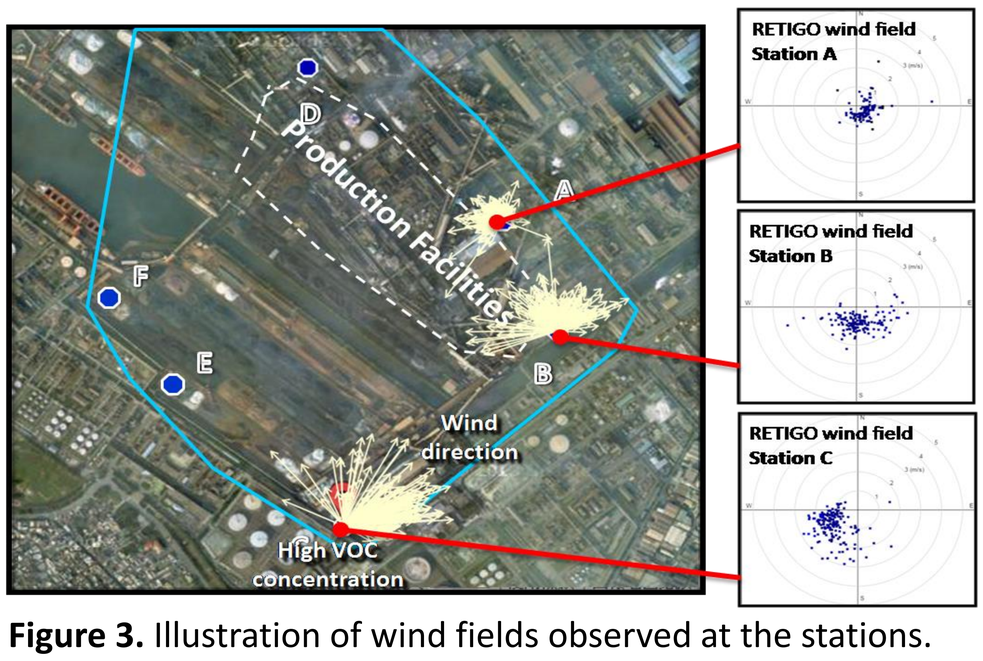

Figure 3. Illustration of wind fields observed at the stations.

Summary

This work has demonstrated a novel gas sensing approach with multiple on-site continuous VOCs monitoring systems forming a detection network at Linhai Industry Park, Taiwan. The method provides a feasible solution to pollution source identification. Furthermore, with the continuous on-site monitoring, it also provides earlier leakage detection for improvement on fugitive VOC reduction control, which cannot be achieved by other methods or instruments in the past.