

A.1 Technology Name

Radiello

A.1.1 Source

Indoor and Outdoor Volatile Organic Compounds Monitoring in a Multi-Storey Car Park. Environmental Engineering and Management Journal, July 2015, Volume 14, Number 7, Gianluigi de Gennaro, Paolo Rosario Dambruoso, Alessia Di Gilio, Annalisa Marzocca, Maria Tutino.

<http://omicron.ch.tuiasi.ro/EEMJ/>

A.1.2 Summary

Media:	Indoor and Outdoor Air
Study Type:	Single Method
Technology:	Radiello Diffusive Sampler
Peer Reviewed:	Yes
Publication Date:	June 2015

A.1.3 Site Description

- A multi-story, rectangular parking garage in an urban area along the Amalfi Coast Highway in Italy. The garage is located near a road tunnel that connects the two busy “resort towns” of Atrani and Amalfi. The structure has one primary entrance, two exits, and includes 204 car and 30 motorcycle parking spaces. The garage is equipped with two ventilation systems: one that distributes outside air throughout the structure and one that vents indoor air to the outside.
- Volatile organic compounds (VOCs), particularly benzene, toluene, ethylbenzene, and total xylenes (collectively known as BTEX).
- Between September 6 and 21, 2013, a total of 40 passive air samples were collected from four outdoor and six indoor sampling locations. The sampling program included four consecutive three-day rounds of sample collection. The samples were then thermally desorbed and analyzed by a laboratory for VOCs.
- The samples were collected using Radiello® diffusive samplers containing graphitized charcoal as adsorbent beds. After being thermally desorbed, laboratory analysis was conducted using a gas chromatography-mass spectrometer.

A.1.4 Remedial Phase

This was a stand-alone study to “characterize the emissions profile,” particularly VOCs, of vehicular traffic in a confined indoor environment.

A.1.5 Outcome

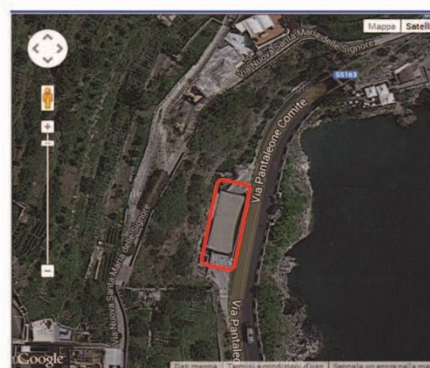


Fig. 1. Position of monitored structure on the Amalfi coast highway

A total of 22 VOCs were detected during these sampling events, with concentrations generally higher in indoor air versus outdoor air. The only exception was on the third floor, where both indoor and outdoor air concentrations were comparable. Of the 22 VOCs detected, BTEX had the highest concentrations in both indoor and outdoor air. However, while concentrations of VOCs in indoor air differed from outdoor air, the averaged ratio of BTEX to total VOCs was 68% for both. The results confirmed the hypothesis that the pattern of detected VOCs and the “degradation phenomena” that characterize traffic emissions in indoor environments differs “from those that commonly occur in urban areas.”

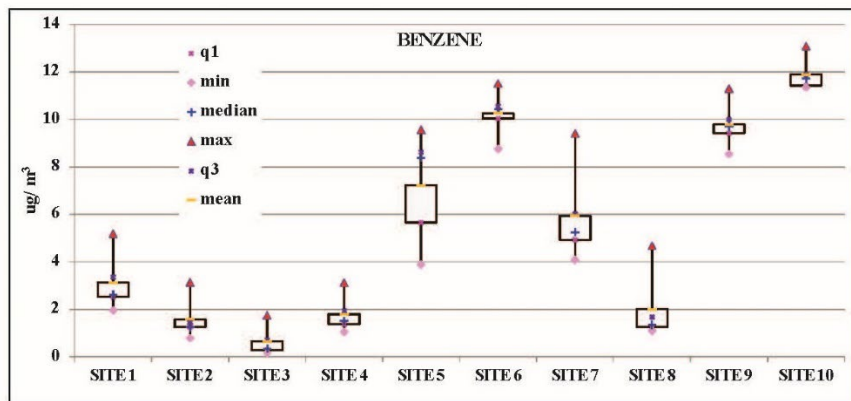


Fig. 2. Trend of the levels of benzene during the monitoring campaign in outdoor sites (1-4) and indoor sites (5-10)

The study further compared the analytical results to those from previous studies that used the same passive sampling methods to show that, even when a strong emission source is present, structural characteristics of the buildings, such as air exchange systems, “could have a considerable impact on the indoor air quality.”

Table 3. Indoor concentration of BTEX and benzene in several not-residential indoor environments

	BTEX ($\mu\text{g}/\text{m}^3$)	Benzene ($\mu\text{g}/\text{m}^3$)	References
Coffee shops	271	5	Bruno et al. (2008)
Libraries	38	2	Bruno et al. (2008)
Copy centers	545	10	Bruno et al. (2008)
Pharmacies	834	7.5	Bruno et al. (2008)
Newspaper stands	690	3	Bruno et al. (2008)
Offices	26	3.3	Bruno et al. (2008)
Gymnasiums	69	1.7	Bruno et al. (2008)
Hairdressing salons	150	2.7	Bruno et al. (2008)
Restaurants	79	2.5	Bruno et al. (2008)
Supermarkets	90	2.2	Bruno et al. (2008)
School Buildings	4.2	0.04-6	de Gennaro et al. (2013)
Multi-storey shopping mall	18	0.7-9	Amodio et al. (2014)
Multi-storey car park	45.6	7.9	This study

Using the radiello passive air samplers, the goals of the project were successfully achieved.

A.1.6 References

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