

WG2

# Chemical Characterization of the Indoor Air Quality of a University Hospital: Contribution of Outdoor and Indoor Sources of Air Pollutants

DiMoPEX

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## Introduction

A hospital is a public facility that should provide a safe indoor environment for patients, visitors and healthcare workers.

## Aim

In this study we looked at the landing and taking-off of helicopters and test runs of a diesel-fueled emergency power supply. These sources appeared regularly in the description of smells as ‘kerosene’ or ‘diesel’ reported by hospital personnel.

## Methods

Simultaneous air measurements were performed on indoor and outdoor locations (Fig. 1). The gas phase was analyzed for VOC, aldehydes and nitrogen dioxide (NO<sub>2</sub>), and samples of respirable dust (PM-4) were collected and analyzed gravimetrically as well as for the B[a]P content of the filter loads. Air sampling was performed continuously in a period of 2 weeks in March 2014 at 11 locations in 5 buildings located around the helicopter platform and power supply. Two older buildings on the university campus (kindergarten and an education building) were used as references. We also characterized the air at the helicopter platform and near power supplies.

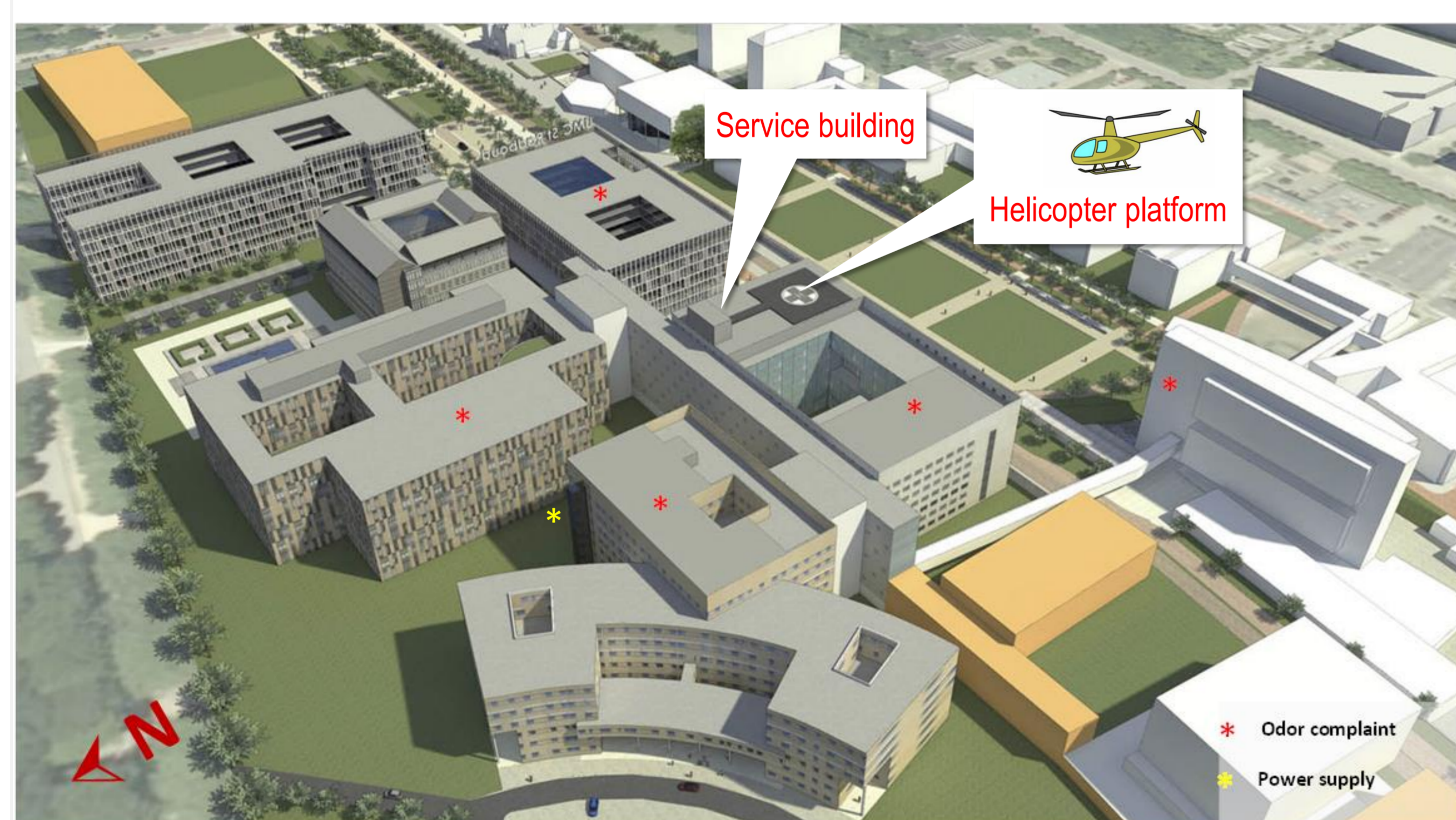


Fig.1: View on helicopter landing platform on the roof of the hospital building; \* Buildings with odor complaints; \* Location of power supply

## Results

We analyzed fuels and performed source measurements at close range (Fig. 2). NO<sub>2</sub> and formaldehyde concentrations were similar on all indoor and outdoor locations, reflecting general outdoor air quality (Table 1). VOC concentrations were elevated compared to reference locations and attributed to disinfection (alcohols) and laboratory practices (aromatic hydrocarbons) and higher in laboratories (316 µg/m<sup>3</sup>) than offices (57.0 µg/m<sup>3</sup>).

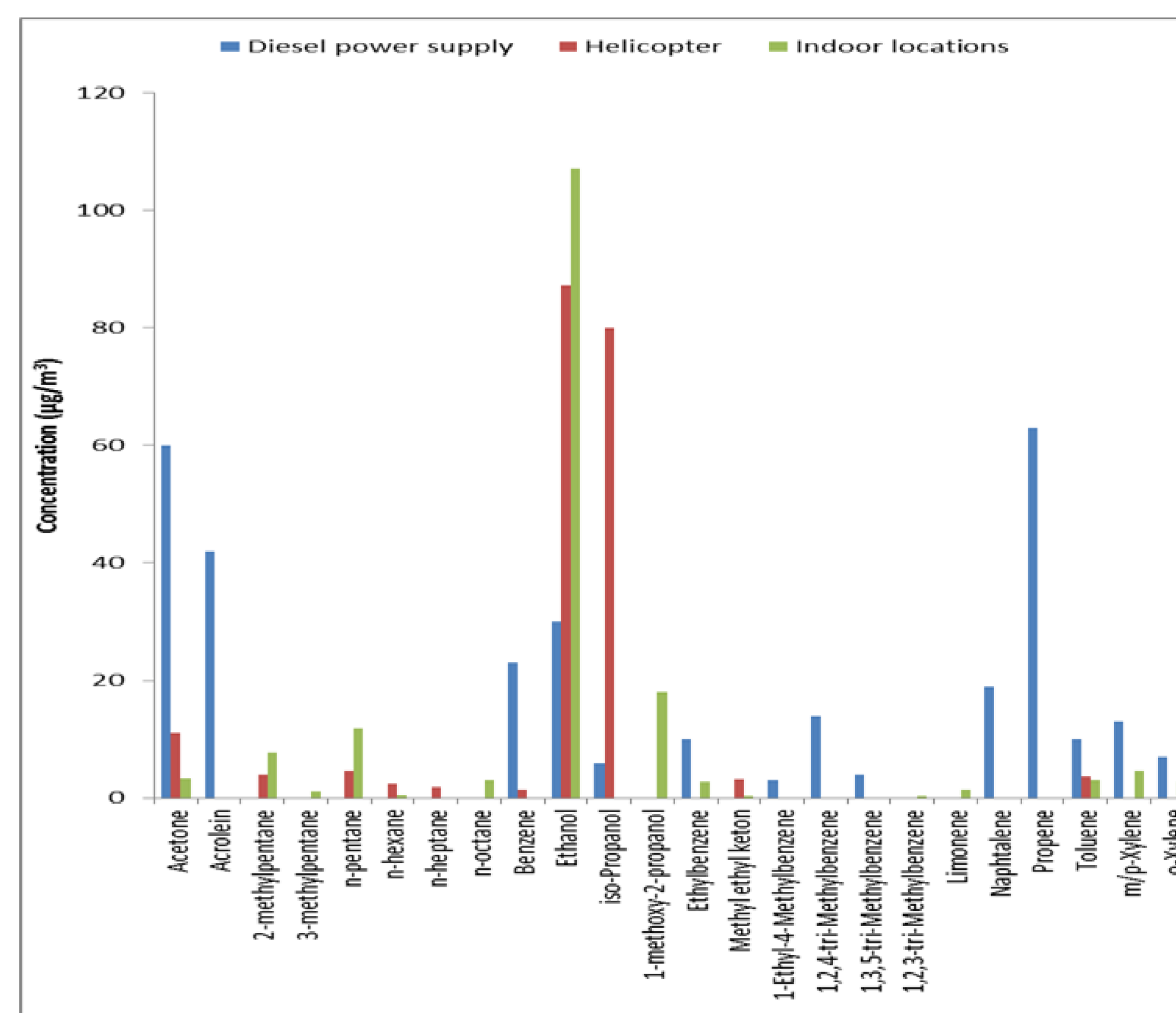


Fig. 2: Comparison of VOC source profiles and mean VOC profile at indoor sampling locations (N=11).

Table 1: Week average indoor and outdoor concentrations (µg/m<sup>3</sup>).

Substance	Week	Helicopter		Indoor locations - Median (range)	
		Indoor <sup>a</sup>	Outdoor <sup>b</sup>	80-90% filters (N=6)	>99.95% filters (N=5)
Acrolein	1	0.17	0.14	0.12 (<0.001-0.14)	0.09 (<0.001 – 0.13)
	2	0.15	0.08	0.11 (0.10-0.19)	0.09 (<0.001 – 0.13)
Formaldehyde	1	9.7	2.6	3.65 (3.1-15.5)	2.9 (2.7-4.7)
	2	9.9	2.9	4.05 (2.2-21.7)	3.5 (3.4-5.2)
NO <sub>2</sub>	1 + 2	11.8	15.5	16.55 (13.6-19.6)	16.20 (4.9-17.0)
TVOC	1	159	12.8	0.34 (56.2-2,928)	0.15 (50.9-2,418)
	2	166	11.2	0.46 (58.0-1,142)	0.30 (33.1-2,449)
PM-4.0	1	6.4	3.7	3.05 (1.5-4.4)	0.50 (<0.01-2.7)*
	2	5.4	28.3	6.90 (3.9-9.4)	0.05 (<0.01-1.0)*
Benz[a]pyrene	1	23	25	35 (24-61)	<0.3 (<0.3)**
	2	55	151	57 (37-68)	<0.3 (<0.3)**

\*  $p < 0.05$  and \*\*  $p < 0.01$ ; <sup>a</sup> Service building; <sup>b</sup> Under helicopter platform

## Discussion

All measurements (indoor/outdoor) were running at the same time, providing a good basis for comparison of the collected air quality data. The indoor measurement locations were selected based on reported odor complaints. In this study we have not collected data on seasonal variations

## Conclusions

- The hospital is a clean indoor environment with small contributions from known outdoor sources.
- High efficiency air filtration units provided very low concentrations of PM-4 and benz[a]pyrene <LOD.
- Infection control and laboratory practices introduced substances that contributed to pollution of the indoor environment.