

# Characterization of chemicals released to the environment by electronic cigarettes use (ClearStream-AIR project)

## Is passive vaping a reality?

G. Romagna MD<sup>1</sup>, L. Zabarini<sup>1</sup>, L. Barbiero<sup>1</sup>, E. Bocchietto<sup>1</sup>, S. Todeschi<sup>1</sup>, E. Caravati<sup>1</sup>, D. Voster<sup>1</sup>, K. Farsalinos MD<sup>2</sup>

1 ABICH S.r.l., biological and chemical toxicology research laboratory, Verbania, Italy

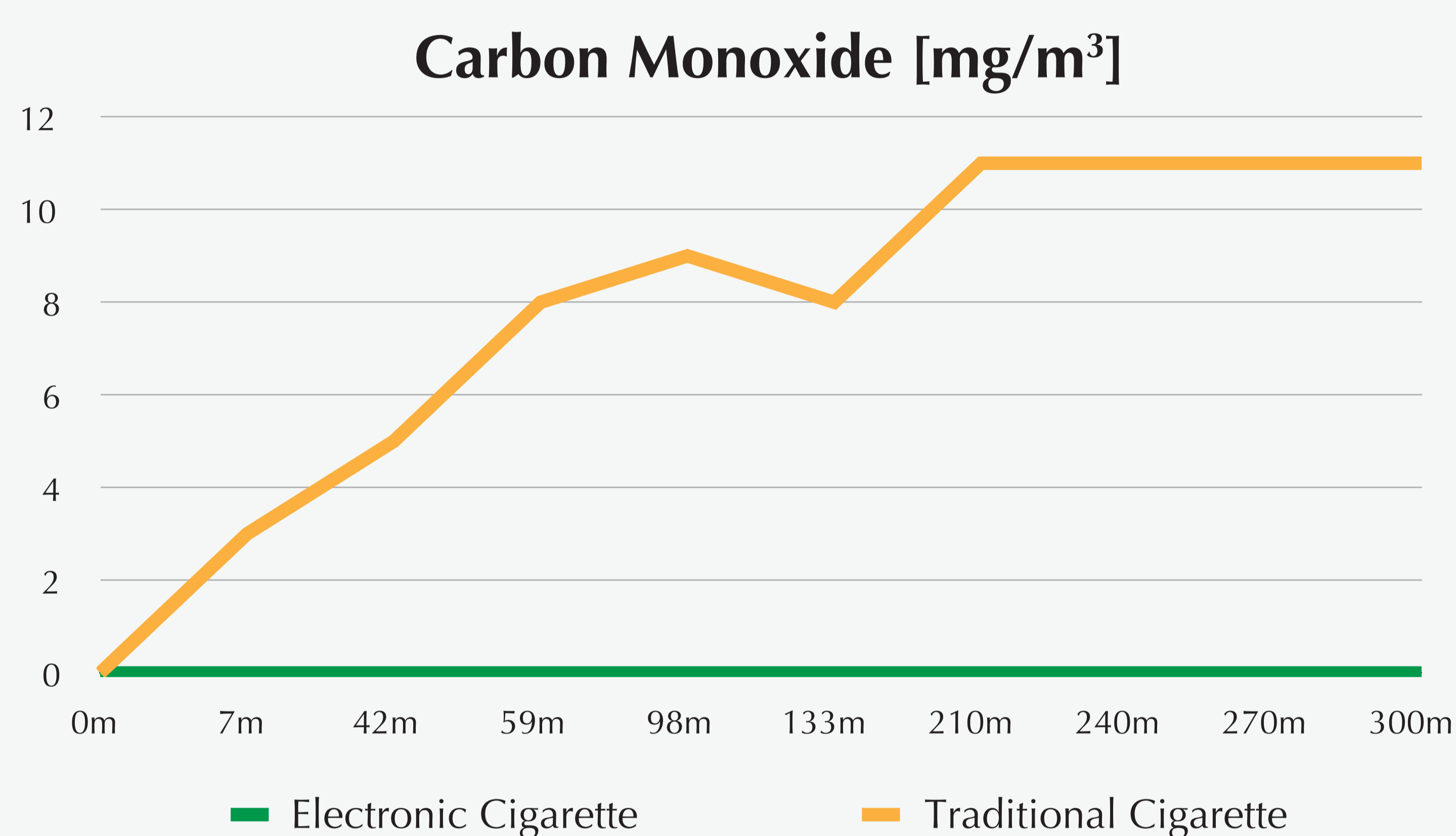
2 Onassis Cardiac Surgery Center, Athens, Greece

### Background

Electronic cigarettes (e-CIG) have been marketed as a safer alternative habit to tobacco smoking. We have developed a group of research protocols to evaluate the effects of e-CIG on human health, called **ClearStream**. No studies have adequately evaluated the effects of e-CIG use on the release of chemicals to the environment. The purpose of this study was to identify and quantify the chemicals released on a closed environment from the use of e-CIG (**ClearStream-AIR**).

### Sessions

	Traditional Cigarette Session	Electronic Cigarette Session
Number of participants	5	5
Age (years)	21	23
Smoking/vaping time (hours)	5	5
No. of cigarettes / ml of eCIG liquid	19	1.6
Nicotine [mg]	11.4	17.6



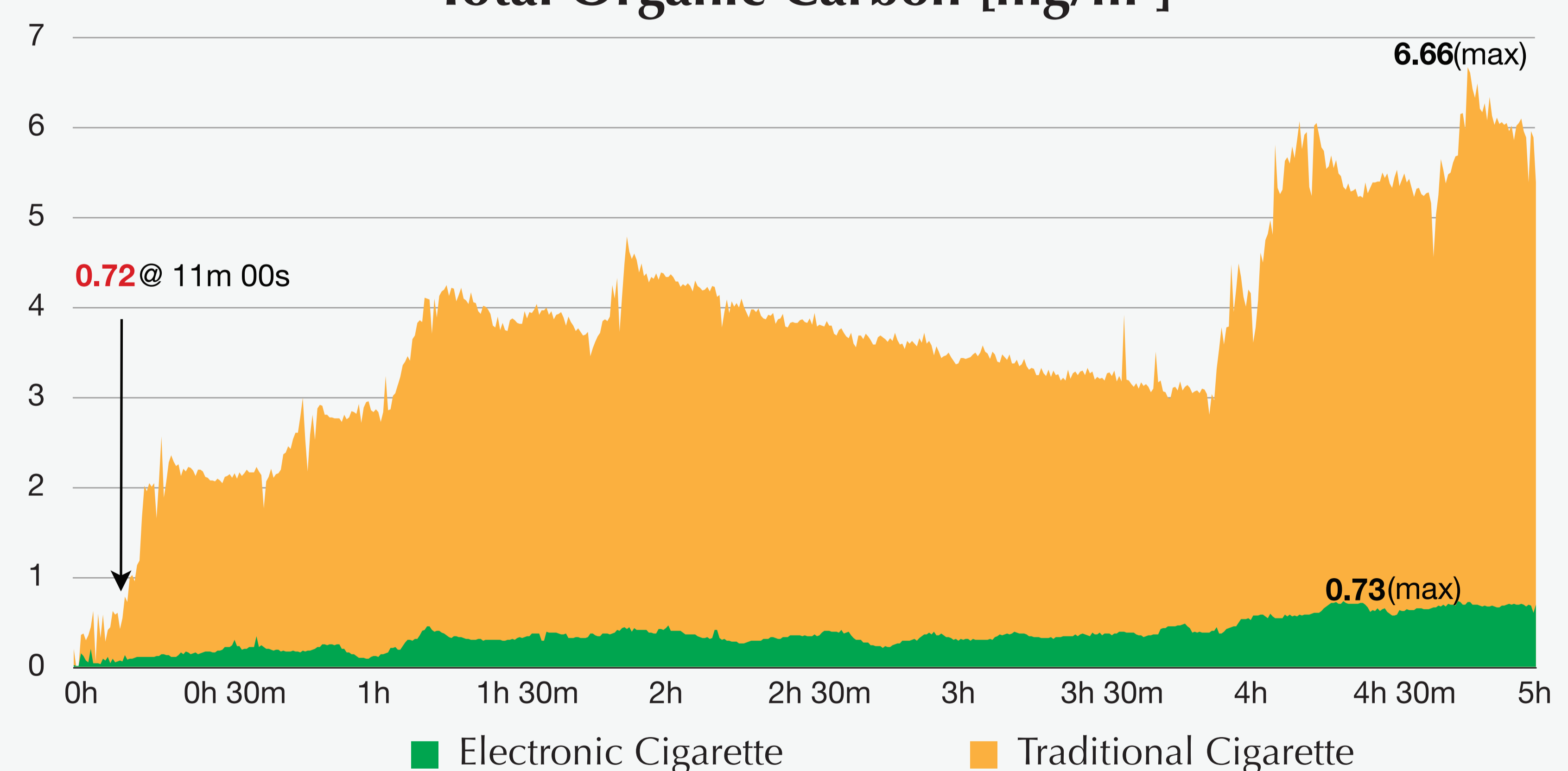
### Methods

A 60 m<sup>3</sup> closed-room was used for the experiment. Two sessions were organized, the first using 5 smokers and the second using 5 users of e-CIG. Both sessions lasted 5 h. Between sessions, the room was cleaned and ventilated for 65 h. Smokers used cigarettes containing 0.6 mg of nicotine while e-CIG users used commercially available liquid (FlavourArt) with nicotine concentration of 11 mg/ml. We measured **total organic carbon (TOC)**, **toluene**, **xylene**, **carbon monoxide (CO)**, **nitrogen oxides (NOx)**, **nicotine**, **acrolein**, **poly-aromatic hydrocarbons (PAHs)**, **glycerin** and **propylene glycol** levels on the air of the room.

### Results

During the smoking session, 19 cigarettes were smoked, administering 11.4 mg of nicotine (according to cigarette pack information). During the e-CIG session, 1.6 ml of liquid was consumed, administering 17.6 mg of nicotine. During the smoking session we found: TOC=6.66 mg/m<sup>3</sup>, toluene=1.7 µg/m<sup>3</sup>, xylene=0.2 µg/m<sup>3</sup>, CO=11 mg/m<sup>3</sup>, nicotine=34 µg/m<sup>3</sup>, acrolein=20 µg/ml and PAH=9.4 µg/m<sup>3</sup>. No glycerin, propylene glycol and NOx were detected after the smoking session. During the eCIG session we found: TOC=0.73 mg/m<sup>3</sup> and glycerin=72 µg/m<sup>3</sup>. No toluene, xylene, CO, NOx, nicotine, acrolein or PAHs were detected on room air during the e-CIG session.

### Total Organic Carbon [mg/m³]



In order to consider the baseline environmental conditions, all values shown in the above chart have been previously reduced by 1 mg/m<sup>3</sup>

### Measured Levels

Parameter	Mean Concentration [µg/m <sup>3</sup> ]	
	Traditional Cigarette	Electronic Cigarette
TOC*	6660	730
Nicotine	34	0
Acrolein	20	0
Toluene	1.7	0
Xylene	0.2	0
PAHs	9.4	0

\*peak concentration

### Conclusions

Passive vaping is expected from the use of e-CIG. However, the quality and quantity of chemicals released to the environment are by far less harmful for the human health compared to regular tobacco cigarettes. Evaporation instead of burning, absence of several harmful chemicals from the liquids and absence of sidestream smoking from the use of the e-CIG are probable reasons for the difference in results.