ECAS-7 2025 Conference

The 7th International Electronic Conference on Atmospheric Sciences

04–06 June 2025 | Online

MDPI

Health risks associated with inhalation exposure to aromatic hydrocarbons (BTEX) in City of Novi Sad

Ljilja Torović[1], Stanka Bobić[2], Slobodan Radišić[2], Nataša Dragić[1,2], Sanja Bijelović[1,2]

[1] Faculty of Medicine, University of Novi Sad

[2] Center for Hygiene and Human Ecology, Institute of Public Health of Vojvodina, Novi Sad

ljilja.torovic@mf.uns.ac.rs

INTRODUCTION & AIM

Road traffic is one of the major sources of air pollutants, including aromatic hydrocarbons.
The current study assessed the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX) in the City of Novi Sad's ambient air and health risk for its inhabitants.

METHOD

***SAMPLING**:* ambient air

Apparatus: Proekos AT 801, charcoal sorbent tubes

Sites: 1 – suburban traffic (Kać), 2 – urban traffic (Novi Sad)

Period: 24 h sampling, Jan-Dec 2024

Samples: 686

Meteorological conditions: RS Hydrometeorological Service (air temperature, air pressure)

***ANALYSIS**:*

Reference method: **EN 14662-2**

Sample preparation: solvent desorption

Instrument: **GC-MS** *(*gas chromatograph with mass spectrometer) (Agilent Technologies 7890B GC 5977B MSD)

Laboratory: Institute of Public Health of Vojvodina, ISO 17025 accredited

RISK ASSESSMENT:

Ec*inh* (µg/m³) = c × ET × EF × ED / ATn

Noncarcinogenic risk: **ATn = ED × 365 × 24**

Carcinogenic risk: **ATn = 70 × 365 × 24**

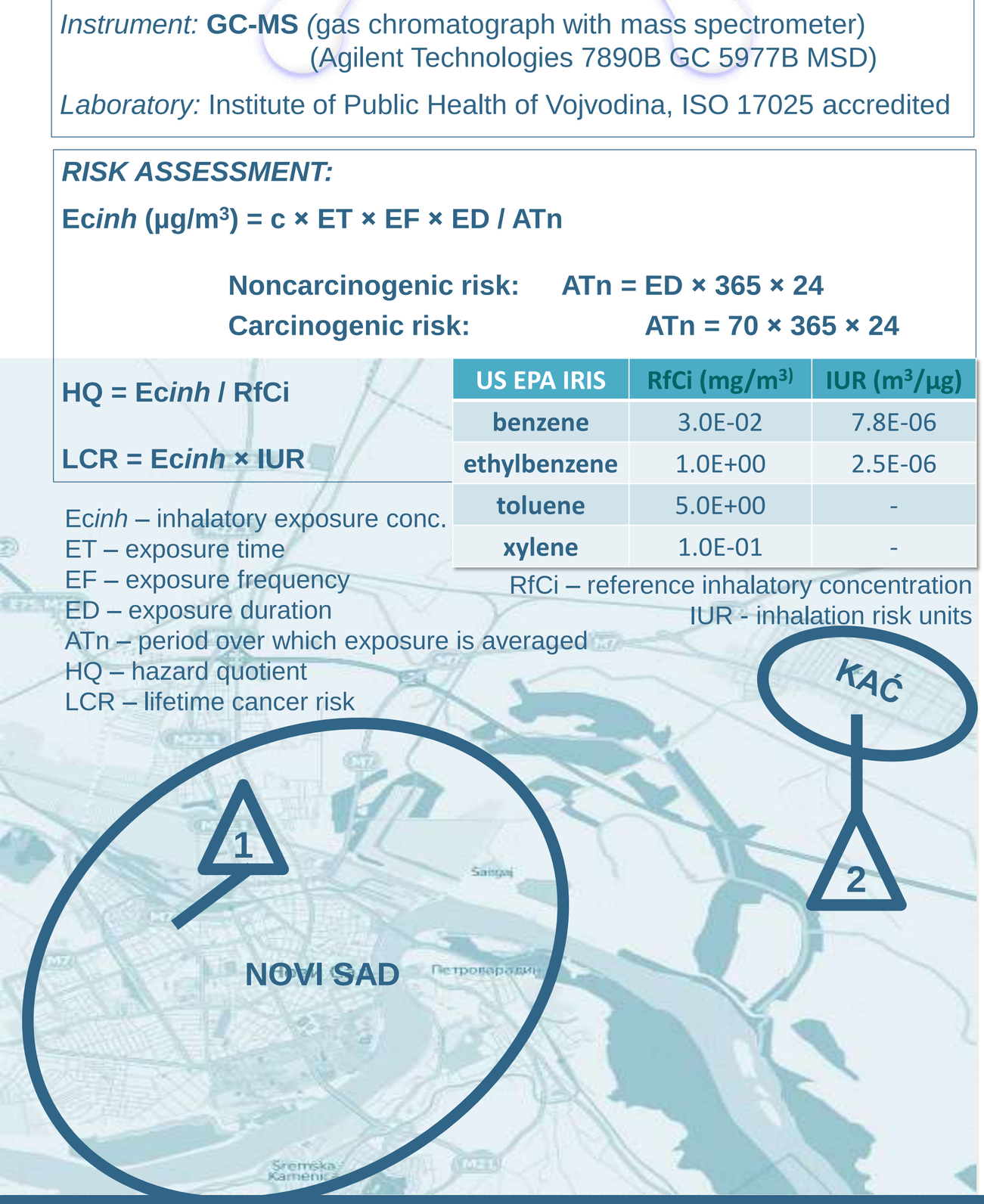
HQ = Ec*inh* / RfCi

LCR = Ec*inh* × IUR

US EPA IRIS	RfCi (mg/m³)	IUR (m³/µg)
benzene	3.0E-02	7.8E-06
ethylbenzene	1.0E+00	2.5E-06
toluene	5.0E+00	-
xylene	1.0E-01	-

RfCi – reference inhalatory concentration
IUR - inhalation risk units

Ec*inh* – inhalatory exposure conc.
ET – exposure time
EF – exposure frequency
ED – exposure duration
ATn – period over which exposure is averaged
HQ – hazard quotient
LCR – lifetime cancer risk



RESULTS & DISCUSSION

Table 1. BTEX concentrations (µg/m³) in ambient air

Site	N	Benzene			Ethylbenzene			Toluene			Xylenes		
		min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	361	0,3	8,3	1,3	0,3	229	1,7	0,3	12,4	2,3	0,5	605	4,2
2	325	0,3	8,0	1,7	0,3	113	1,0	0,3	45,7	3,9	0,5	327	2,6

Table 2. Toxicological risk assessment of BTEX in ambient air

		Exposure	HQ		Exposure		LCR	
		Children / Adults	Non-carcinogenic risk		Children	Adults	Carcinogenic risk	
		µg/m³	Children	Adults	µg/m³	µg/m³	Children	Adults
BTEX	**Site**							
Benzene	1	1,3E+00	4,4E-02	4,4E-02	1,9E-01	7,5E-01	1,5E-06	5,9E-06
	2	1,7E+00	5,7E-02	5,7E-02	2,4E-01	9,8E-01	1,9E-06	7,6E-06
	All	1,5E+00	5,1E-02	5,1E-02	2,2E-01	8,7E-01	1,7E-06	6,8E-06
Ethyl benzene	1	1,7E+00	1,7E-03	1,7E-03	2,4E-01	9,4E-01	5,9E-07	2,4E-06
	2	1,0E+00	1,0E-03	1,0E-03	1,5E-01	5,9E-01	3,7E-07	1,5E-06
	All	1,3E+00	1,3E-03	1,3E-03	1,9E-01	7,7E-01	4,8E-07	1,9E-06
Toluene	1	2,3E-06	4,6E-10	4,6E-10				
	2	3,9E-06	7,8E-10	7,8E-10				
	All	3,1E-06	6,2E-10	6,2E-10				
Xylenes	1	4,2E+00	4,2E-02	4,2E-02				
	2	2,6E+00	2,6E-02	2,6E-02				
	All	3,4E+00	3,4E-02	3,4E-02				
Σ	1	HI	0,087	0,087		LCR	2,1E-06	8,2E-06
	2		0,085	0,085			2,3E-06	9,1E-06
	All		0,086	0,086			2,2E-06	8,7E-06

***BTEX compounds occurrence**:*
toluene 94.3% > benzene 88.3% > xylenes 75.6% > ethylbenzene 59.0%. The mean concentrations of benzene and toluene were higher at the urban-traffic site, while ethylbenzene and xylenes reached higher means at the suburban-traffic site.

Regulatory compliance
Benzene annual concentration complied with the calendar year limit established by the EU Directive 2008/50/EC.

Non-carcinogenic risk
The hazard index (HI) values, calculated as the sum of HQs related to individual BTEX compounds, indicated no health risk.
Benzene and xylenes were the main HI contributors (>98%).

Carcinogenic risk
The risk levels were very close at both sites in the case of children, while for adults, slightly higher at the urban traffic site. However, the risk was low for both population groups.
Due to its higher inherent carcinogenic potential and higher population exposure level, benzene showed 2.5-fold higher impact on carcinogenic risk than ethylbenzene.

CONCLUSION

Although the estimated risk levels are low, reducing exposure to carcinogenic compounds via ambient air is highly important.

REFERENCES

Directive 2008/50/EC on ambient air quality and cleaner air for Europe. OJ, 2008, L152.