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Health risks associated with inhalation exposure to benzo(a)pyrene in City of Novi Sad

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INTRODUCTION & AIM

The polycyclic aromatic hydrocarbons (PAHs) in the ambient air can pose a serious health risk for humans when inhaled, usually adsorbed on particulate matter (PM).

The study aimed to investigate benzo(a)pyrene (BaP), the most famous representative of PAHs, in PM10 (inhalable PM, with a diameter up to 10 µm) in City of Novi Sad ambient air and to assess associated health risks.

METHOD

***SAMPLING**:* ambient air

Reference method: **EN 12341**

Apparatus: Sven Leckel sequential sampler with sampling inlet for PM10 (Quartz fiber filters)

Sites: 1- basic rural, 2 - basic urban, 3 - suburban traffic, 4 - urban traffic, 5 - industrial

Period: 24 h sampling, Jan-Dec 2024

Samples: 1340

***ANALYSIS**:*

Reference method: **EN 15549**

Sample preparation: ultrasound assisted extraction (acetone/hexane), SPE clean-up (C18 columns)

Instrument: **GC-MS** Agilent Technologies 7890B GC / 5977B MSD

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

RISK ASSESSMENT:

Ec*inh* (ng/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)
BaP	2,0E-06	6,0E-04

RfCi – reference inhalatory concentration

IUR - inhalation risk units

Ec*inh* – inhalatory exposure concentration

ET – exposure time

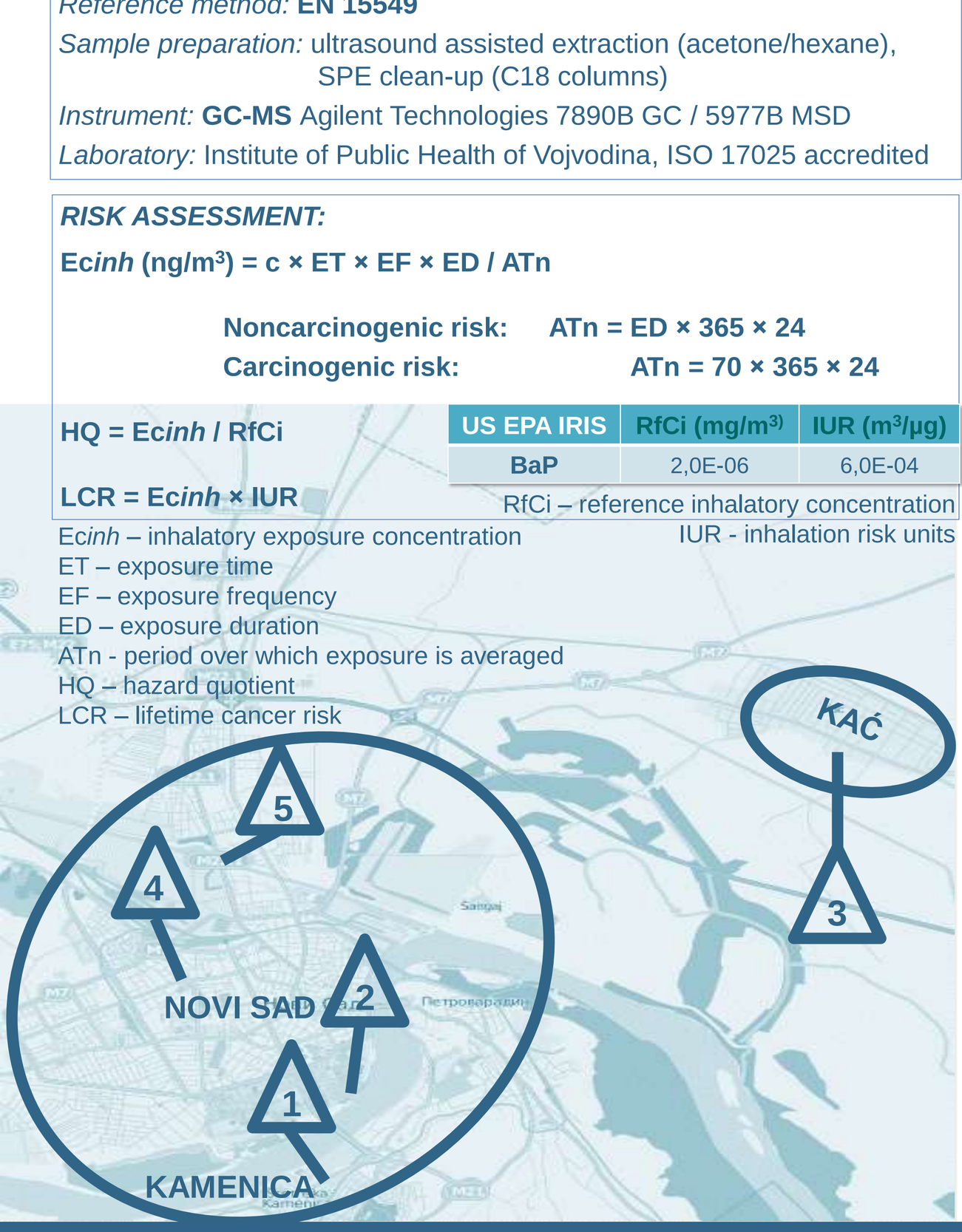
EF – exposure frequency

ED – exposure duration

ATn - period over which exposure is averaged

HQ – hazard quotient

LCR – lifetime cancer risk



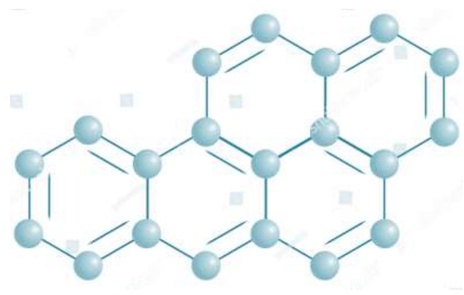
RESULTS & DISCUSSION

Table 1. BaP concentrations (ng/m³) in ambient air

Site	1	2	3	4	5
N	223	286	227	330	274
min	0,25	0,25	0,25	0,25	0,25
max	4,7	3,3	5,6	7	7
mean	0,8	0,5	0,9	0,7	0,8

Table 2. Toxicological risk assessment of BaP 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
PAH	**Site**							
BaP	1	7,6E-04	0,38	0,38	1,1E-04	4,4E-04	6,5E-08	2,6E-07
	2	5,3E-04	0,26	0,26	7,5E-05	3,0E-04	4,5E-08	1,8E-07
	3	9,3E-04	0,47	0,47	1,3E-04	5,3E-04	8,0E-08	3,2E-07
	4	7,0E-04	0,35	0,35	10,0E-05	4,0E-04	6,0E-08	2,4E-07
	5	7,9E-04	0,39	0,39	1,1E-04	4,5E-04	6,7E-08	2,7E-07
	All	7,4E-04	0,37	0,37	1,1E-04	4,2E-04	6,4E-08	2,5E-07



BaP occurrence

The overall share of the samples with quantified BaP was 46.6% (53.8% basic-rural > 53.7% suburban-traffic > 49.3% industrial > 45.2% urban-traffic > 34.6% basic-urban site).

The lowest mean concentration was recorded at the basic-urban site (0.5 ng/m³), while the highest was related to suburban traffic (0.9 ng/m³).

When averaged over all monitored sites, BaP level was 0.7 ng/m³.

Regulatory compliance

The annual level of BAP complied with the EU regulatory requirements.

Non-carcinogenic risk

HQ was below the limit value 1 on all monitored sites (0.24-0.47, overall average 0.37), indicating no risk.

Carcinogenic risk

LCR was negligible for children (from 4.5E-08 to 8.0E-08, mean 6.4E-08) and adults (from 1.8E-07 to 3.2E-07, mean 2.5E-07).

CONCLUSION

Although estimated risk levels are low, the population is exposed not only to BaP but also to other carcinogenic PAHs, and not only by inhalation but also through consumption of foods such as grilled and smoked food.

It is important to reduce population exposure to carcinogenic compounds by all relevant exposure pathways.

REFERENCES

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