

**THE OZONE INFLUENCE  
RISK ASSESSMENT ON POPULATION HEALTH:  
OPTICAL INSTRUMENT OF OZONE CONCENTRATION MEASUREMENT**

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**ABSTRACT**

The ozone monitoring in Belarus is not conducted. The European guideline value for ozone differed from accepted in Belarus. We've established the new threshold level of ozone (maximum permissible concentration) and developed "The Optical Route Instrument Of Ozone Concentration Measurement - Trio", which is established for the control at Ozone Monitoring Minsk's Station №354 of European networks in the beginning of 2004. The purpose of measurement: definition of ozone concentration in ambient air in natural conditions (without selection of tests). The software for automatic mode is developed. A range of concentration is 0-200 ppb (0-400 мкг/м<sup>3</sup>). Limits of the basic absolute error + 1.45 ppb. The validation of the technique have been made by using TEI49C ozone analyzer with internal ozone calibrator. The data proved to be true by means of comparative measurements with use of the transportable industrial UV photometric O<sub>3</sub> analyzer (model 49C, Thermo Environmental Instruments - USA). Similar optical Trio is entered into operation at station of background monitoring Berezinsk's Bio Sphere Park.

The Ministry of Health of the Republic of Belarus are responsible for the Social-Hygienic Monitoring (SHM) according to the Law "About Sanitary-Epidemic Well-being of Population". For this purpose we have the Hygiene&Epidemiology Centers, where the environment quality and population health is observed and supervised. We prepare the State Annual Report "Sanitary-Epidemic Situation at Belarus", which is the global official document with objective information about sanitary-epidemic situation in regions, conditions and factors of population health formation, accepted and necessary actions on a population health protection for the state management.

**TEXT**

As is known, hygienic estimation of a regional exposition ozone, the assessment of zones and agglomerations, in which the levels of ozone in ambient air are higher than the target values or higher than the maximum permissible concentration are very important for Environmental Health Information System according to Declaration of the Fourth Ministerial Conference on Environment and Health, Budapest, Hungary, 23–25 June 2004.

The adverse effects of air pollutants such as nitrogen dioxide, sulfur dioxide, particulate matter, carbon monoxide and specific substances such as formaldehyde, phenol, PAH, H<sub>2</sub>S, NH<sub>3</sub>,

etc. Besides, really more than 200 organic chemicals have been detected by chromat-mass-spectrometric analysis, most part of them are alkanes and aldehyde, aromatic hydrocarbons (derivatives of benzene), cycloalkanes

The hygienic estimation of the air pollution danger was conducted according to the maximum permissible concentration, quantity chemicals and class of danger, bioequivalent effect, the long-time average. We have Y degrees: 0 - permissible, I - weak, II - moderate, III - strong, IV - dangerous.

**TABLE 1.** The hygienic estimation of the air pollution danger

City	Air pollution levels		Danger degree	
	M±m; δ	y=a±bx; r; p	fact	prognosis
Brest	3.250± 0.54 δ = 2.15	y = 0.49 + 0.32x; r = 0.72; P ≤ 0.01	moderate	strong
Vytebsk	4.65 ± 0.71 δ = 2.86	y = 2.18 + 0.29x; r = 0.48; P ≥ 0.05	moderate,	moderate
Gomel	4.11 ± 0.41 δ = 1.65	y = 2.04 + 0.24x; r = 0.70; P ≤ 0.01	moderate,	сильная
Grodno	1.58 ± 0.27 δ = 1.10	y = 1.11 + 0.05x; r = 0.24; P ≥ 0.05	permissible	слабая
Minsk	3.28 ± 0.32 δ = 1.29	y = 3.21 + 0.08x; r = 0.30; P ≥ 0.05	moderate	moderate
Mogilev	6.45 ± 0.84 δ = 3.37	y = 7.54 - 0.13x; r = 0.18; P ≥ 0.05	strong	strong

Also, we carried out the retrospective epidemiological analysis of primary morbidity some diseases: respiratory disease, pneumonia, bronchitis, asthma.

**TABLE 2.** The asthma morbidity levels. Cases on 100 thousand adult population.

City	Average level M±m σ	Trend y = f(x)	Prospect level (min-max)
Brest	10.02 ± 0.91 σ = 3.41	ó = 7.64 + 0.32δ; r = 0.39; p ≥ 0.05	8.02 - 11.98
Vytebsk	20.14 ± 3.89 σ = 14.58	y = 0.33 + 2.64x; r = 0.76; p ≤ 0.01	11.74 - 28.5
Gomel	11.68 ± 1.79 σ = 6.69	y = 1.63 + 1.34x; r = 0.84; p ≤ 0.01	7.88 - 15.52
Grodno	23.57 ± 1.66 σ = 6.22	y = 17.63 + 0.79x; r = 0.53; p ≤ 0.05	19.97 - 27.14
Minsk	12.11 ± 1.59 σ = 5.96	y = 2.28 + 1.31x; r = 0.92; p ≤ 0.01	8.71 - 15.53
Mogilev	16.21 ± 1.78 σ = 6.66	y = 6.08 + 1.35x; r = 0.85; p ≤ 0.01	12.41 - 20.04

We develop the risk assessment medical questionnaire on acute influence exposition of concentration ozone on a children health. It is represented important to analyze peaks asthma at children during a maximum daily 8 hour mean of 120  $\mu\text{g}/\text{m}^3$  ozone concentration.

The National Ozone Monitoring Research Center has developed the device "The Optical Route Instrument Of Ozone Concentration Measurement - Trio" and has received the Certificate N1905 at February 06, 2004. "Trio" which is established for the control at Ozone Monitoring Minsk's Station №354 of European networks. The purpose of measurement: definition of ozone concentration in ambient air in natural conditions (without selection of tests).

The software for automatic mode is developed. A range of concentration is 0-200 ppb (0-400  $\text{MKГ}/\text{M}^3$ ). Limits of the basic absolute error + 1.45 ppb. The validation of the technique have been made by using TEI49C ozone analyzer with internal ozone calibrator. The data proved to be true by means of comparative measurements with use of the transportable industrial UV photometric  $\text{O}_3$  analyzer (model 49C, Thermo Environmental Instruments - USA). Similar optical Trio is entered into operation at station of background monitoring Berezinsk's Bio Sphere Park.

Since July 21 and up to the end of month the ozone concentration close to a maximum permissible concentration (60 ppb = 120  $\text{MKГ}/\text{M}^3$ ) were observed. Let's notice, that the maximal concentration per solar days are achieved by 15-16 to hours, July 21 by 15 hours, for example, the concentration ozone has achieved 82 ppb. From August 16 till August 21 as the greatest concentration ozone were observed. In the first 10 days of September the ozone concentration at a level 20-30 ppb were registered. For statistical processing of the information about frequency distribution of man-days depending on concentration ozone (for each interval of concentration) the software is developed.

Also, we carried out the retrospective epidemiological analysis of primary morbidity level of some diseases: respiratory illnesses, pneumonia, bronchitis, asthma. We establish the children morbidity tendencies and prognoses in 5 region of Minsk, which contrast on air pollution (nitrogen dioxide, carbon monoxide, formaldehyde, phenol, VOC, aldehyde, aromatic hydrocarbons, etc.).

In one of 5 areas the regular monitoring ozone is carried out.