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ASPECTS ON THE INFLUENCE OF AIR POLLUTION CONCERNING LIVING ORGANISM

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Introduction

The research on atmospheric air pollution around industrial platforms has revealed large quantities of atmospheric pollutants that have negative affects on the technical state of the installation became apparent through corrosion on metallic parts and the decrease of the insulation quality of the electrical insulators. To determine the degree of dispersion and aggressiveness of nitrogen dioxide, the most important pollutant, the research was conducted between 1998 – 2000 on the level of impurities in air by determining the concentration of nitrogen oxides at different distances from the pollution sources, around electrical network.

Organizing gaze gathering from the environment

To gather polluted air, the followings were established:

– Mobile gathering centers to determine momentary concentration in mg N_2O_5/m^3 air, generally placed around pollution sources at the height of 1.5 m from the ground and at the distances of 0.5 – 6, 8, and 10 km from the sources, with probe distances of 15, 20 and 30 km.

– Fixed gathering centers to determine average concentration in mg N_2O_5/m^3 air in 24 hours, placed around the pollution sources at distances between 0.5 and 6 km, especially in the dominant wind direction.

– Mobile gathering centers through temporary sedimentation, to determine the quantities of nitrogen oxide deposited on the ground in mg N_2O_5/m^2 hour gathered in parallel with the temporary probe through aspiration.

– Fixed gathering centers through sedimentation, to determine the nitrogen oxide quantities deposited on the ground in N_2O_5/m^2 in 24 hours.

Table 1 shows the minimum, maximum and average values of the determinations from the momentary gatherings of nitrogen oxide, which result from the measurements done by the authors.

The influence of the degree of pollution on personnel

To underline the effects of pollution on living organism it is necessary to compare the values from the determination of pollutant concentration on volume unit with the biologically admitted limits on the same unit. In the first analysis this comparison was possible by determining the repartition density in a certain time in which the measurements were grouped.

For this, we shell calculate the cumulated frequency of the repartition function F_x^* using the relationship:

$$\int_x^{x+\Delta x} f(x)\,dx = F_x^{x+\Delta x} = F_x^* \qquad (1)$$

This frequency is obtained by the successively adding of spaces x, $x + \Delta x$, considering for the first interval $x = 0$.

Numerical results

Using the results from the determination in table 1, the ordinates from table 2 for the calculated F_x^* values we can establish the relationship with the environment (influence connections).

The sense of these influences is considered to be over the quantities limit of pollution, which can produce organism perturbation.

For this it is sufficient to establish the amount of F_x^* values, which is placed under the x_{MA} values biological admitted.

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Table 1. Minimum, maximum and average values of nitrogen oxides from momentary gathering

km / N_2O_5 mg/m^3		Gathering place in km from source								
		0,5	1	2	3	4	5	6	8	10
Spring	X_{mk}	0.091	0.112	0.014	0.062	0.125	0.079	0.15	0.076	0.007
	X_{MK}	0.274	0.526	0.573	0.505	0.508	0.15	0.19	0.234	0.245
	$\overline{X}$	0.16	0.244	0.223	0.274	0.24	0.12	0.17	0.105	0.126
Summer	X_{mk}	0.195	0.3	0.21	0.33	0.11	0.15	0.09	0.158	0.108
	X_{MK}	0.9	0.81	0.36	0.69	0.29	0.26	0.16	0.23	0.14
	$\overline{X}$	0.492	0.589	0.32	0.47	0.18	0.205	0.13	0.16	0.128
Winter	X_{mk}	0.072	0.11	0.08	0.071	0.085	0.05	0.094	0.082	–
	X_{MK}	0.62	1.22	0.3	0.34	0.36	0.48	0.35	0.22	–
	$\overline{X}$	0.264	1.32	0.19	0.23	0.275	0.19	0.16	0.154	–
Summer	X_{mk}	0.023	0.083	0.094	0.095	0.016	0.038	0.018	0.021	0.118
	X_{MK}	0.158	0.183	0.15	0.254	0.247	0.2	0.143	0.143	0.156
	$\overline{X}$	0.12	0.129	0.125	0.135	0.12	0.126	0.109	0.105	0.137
Winter	X_{mk}	0.26	0.107	0.078	0.078	0.05	0.08	0.07	0,074	–
	X_{MK}	0.5	0.21	0.25	0.67	0.17	0.6	0.53	0.36	–
	$\overline{X}$	0.297	0.168	0.14	0.361	0.11	0.23	0.21	0.201	–

From the data showed in the diagram, it results that the repartition density varies in considered intervals following second degree curve. This means that the repartition frequencies in the three intervals in which the measurements were grouped will be [1]:

$$F_x = \int_0^{0.5} f(x)\,dx = \int_0^{0.5} \left(b_0 + b_1 \cdot x + b_2 \cdot x^2\right)dx = 87.5$$
$$F_x = \int_{0.5}^{1} f(x)\,dx = \int_{0.5}^{1} \left(b_0 + b_1 \cdot x + b_2 \cdot x^2\right)dx = 10.97 \quad (2)$$
$$F_x = \int_1^2 f(x)\,dx = \int_1^2 \left(b_0 + b_1 \cdot x + b_2 \cdot x^2\right)dx = 1.2$$

Data determinations on N_2O_5 mg/m^3 contained in the atmospheric air around chemical platforms and polluted towns around them is used to calculate the integrals. By resolving the three integrals an equation system is obtained:

$$\begin{aligned} 0.5 \cdot b_0 + 0.125 \cdot b_1 + 0.041 \cdot b_2 &= 87.5 \\ 0.5 \cdot b_0 + 0.375 \cdot b_1 + 0.290 \cdot b_2 &= 10.97 \\ b_0 + 0.5 \cdot b_1 + 2.33 \cdot b_2 &= 87.5 \end{aligned} \quad (3)$$

The next coefficients matrix results from the system solution:

$$\begin{vmatrix} b_0 \\ b_1 \\ b_2 \end{vmatrix} = \begin{vmatrix} 229.3 \\ -170.29 \\ -133.93 \end{vmatrix} \quad (4)$$

The variation of the repartition density for the accomplished measurements is given by the equation:

$$F_x^* = 229.3 - 170.29 \cdot x - 133.93 \cdot x^2 \quad (5)$$

Using this equation the cumulated frequency of the repartition density can be determined for any interval.

Table 2. The cumulated frequency on the repartition density

N_2O_5 mg/m^3 air interval		Frequency		X_{mk}	X_{Mk}	$\overline{X}$	X_{MA}
		f_x	F_x*				
0	1	2	3	4	5	6	7
Total	82	–	–	–	–	–	–
	–	–	–	42	24	38	0.5
0 – 0.5	72	72	87.8	1	5	4	0.5
0.5 – 1	9	81	19.97	0	9	0	0.5
1 – 2	1	82	1.2	0	1	0	0.5

The relationship men-environment becomes insignificant if the following condition is met:

$$F_x^* < x_{MA}$$
$$F_x^* \to \sum_{k=1}^{n} x_k \qquad (7)$$

Conclusions

Knowing that x_{MA} is equal to 0.3 we can verify this condition by calculating the repartition density frequency for the interval (0 – 0.3). Using the equation 6 we can obtain:

$$F_x^* = 229.3 \cdot 0.3 - 170.29 \cdot 0.045 - 133.93 \cdot 0.009 = 60\%$$

The fact that from the 87.8% of values disposed in (0 – 0.5) interval only 60% are smaller x_{MA} leads to the conclusion that the men-environment relationship is significant.

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Summary

The concentration of nitrogen oxides around petrochemical platforms has a negative effect on the quality of conductor materials and on insulators as well as, at certain concentrations, on the working personnel of electrical installations. Concentrations of nitrogen oxides from different distances from the polluting agent and in different seasons were studied. The distribution law of nitrogen oxides and the state in which these affect the working personnel were studied.