

## **DESCRIPTIVE ANALYSIS OF THE POLLUTION BY NITROGEN OXIDES IN ROSARIO CITY**

TOPICS: EN01

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### **ABSTRACT**

The present work has as an object to show the levels reached by the pollution by Nitrogen Oxides (NO<sub>x</sub>), existing in the urban environment of Rosario City, Santa Fe Province, Argentina.

These values are obtained by means of the operation of Continuous Monitoring Net of the environment of the City, with measurement stations of chemical type and that seek to follow the features of the Global Environmental Monitoring Systems (G.E.M.S.), belonging to the United Nations Program (U.N.E.P.).

From the beginning of the year 1994, it was begun to investigate the degree of air pollution of the city in relationship to four primary pollutants. They were selected, by this purpose, Nitrogen Oxides (NO<sub>x</sub>), Sulphur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO) and Precipitable Solids. Along of almost two years of practice, it was selected the Nitrogen Oxides (NO<sub>x</sub>) as an object of this written work, because sulphur oxides (SO<sub>2</sub> and SO<sub>3</sub>) -of great importance pollutant in other parts of the world such as Europe and North America- has no incidence in Rosario. This remained demonstrated along a year and a half of continuous measurements in four sampling stations situated two in the centre of the city and two in suburban area. In one of them -the one situated in North area- it were registered tracks, and this because of the influence of the boundary industrial sector where there are companies devoted to Sulfuric Acid fabrication, refineries of oil, petrochemicals and cellulose industries. Rosario City has around of a million of inhabitants and it is located in the eastern

**Table 1 - MONTHLY DESCRIPTIVE ANALYSIS - 1995**  
 Media, Standard Deviation, Variation Coefficient, Confidence Limits  
 NOx(Micrograms/m<sup>3</sup> air)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	67	46	70	73	--	161	97	74	132	134	109	161
2	67	44	67	80	64	181	86	74	116	117	101	142
3	27	50	99	62	45	186	86	82	116	83	108	142
4	25	56	99	65	38	186	120	157	142	110	96	181
5	8	38	70	53	96	81	107	258	86	201	96	196
6	16	43	55	64	96	76	122	258	79	186	83	153
7	16	43	46	44	61	205	156	358	110	117	271	267
8	23	30	46	44	60	354	--	158	89	117	192	127
9	87	28	119	44	89	188	--	161	85	178	187	118
10	87	63	119	77	63	107	134	123	85	165	161	118
11	94	51	119	155	104	107	73	204	109	142	108	203
12	50	49	59	78	73	102	60	126	96	116	108	196
13	47	42	42	136	73	84	46	126	133	124	108	300
14	31	42	42	90	91	191	44	104	125	189	270	202
15	31	72	55	90	99	246	44	58	253	189	203	208
16	31	65	81	90	68	134	44	94	87	189	213	155
17	71	53	38	158	122	161	58	143	87	111	188	151
18	73	70	19	89	166	161	58	192	87	155	107	261
19	30	70	19	113	76	161	70	198	97	164	107	217
20	26	70	--	123	76	104	82	198	173	164	107	148
21	41	132	--	163	68	119	48	83	116	119	252	188
22	--	77	--	163	145	103	41	144	132	119	305	198
23	37	77	39	119	184	70	41	--	133	119	--	85
24	78	89	45	83	185	89	119	101	133	--	248	--
25	79	89	45	109	165	89	90	80	84	138	160	93
26	79	95	14	152	112	80	130	52	134	113	160	131
27	74	95	48	134	183	124	94	52	97	--	160	141
28	40	59	62	--	183	118	124	131	114	173	278	177
29	40	--	100	--	167	111	72	148	114	173	169	200
30	61	--	77	--	128	112	72	119	134	173	187	114
31	61	--	73	--	144	--	92	145	--	211	--	114
Media	50	62	63	98	107	140	83	140	116	148	167	170
StdDev	25	23	29	38	46	60	32	68	34	33	65	50
Varian	600	525	859	1443	2080	3579	1035	4578	1149	1120	4194	2531
V. Coef	49	37	46	39	42	43	39	48	29	23	39	30
LowLim	41	54	52	84	91	118	71	116	104	136	143	152
HighLim	59	71	74	112	124	161	95	164	128	160	191	188

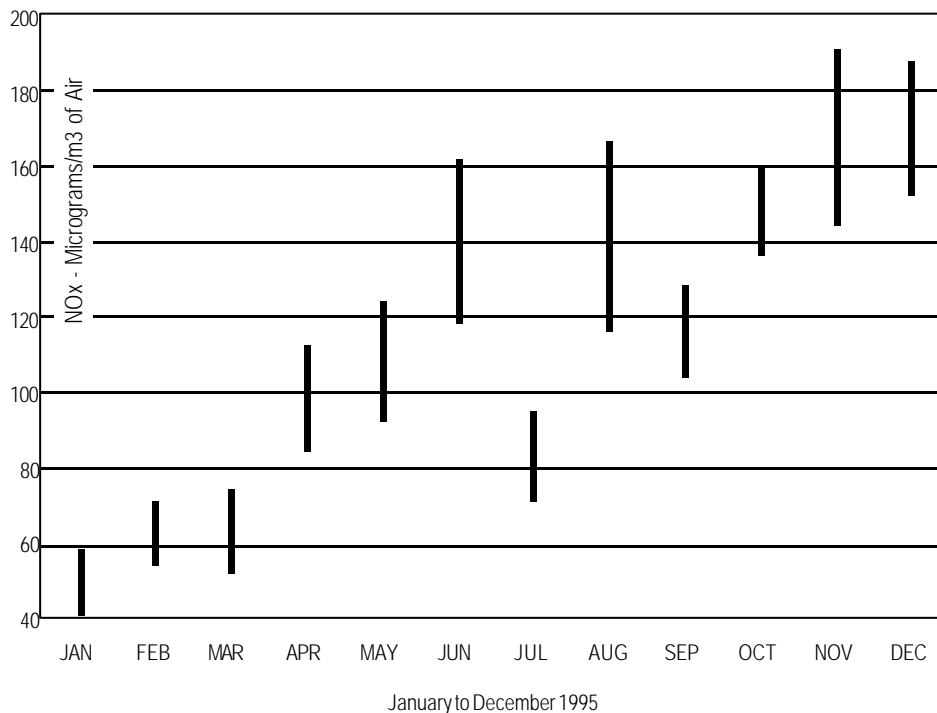
zone of the wet extensive plain, by the bank of an important river (Paraná River). The city present a form of larger length in the North-South direction, accompanying the trench river. It suffers almost permanently the action of the winds that help in the elimination of many gaseous pollutants that continually are produced in this city, but however the concentrations of some of them in central areas of the city, overcome frequently the allowed values by the municipal Laws, and the ones that are advised by National and International legislations.

With the obtained data for the Nitrogen Oxides (NO and NO<sub>2</sub>), a descriptive study of the concentrations of the above mentioned pollutant, was done with statistics technical . With the results of this studies it is realized a pursuit of the reached values of the concentrations during the different months and seasons of the year.

### TEXT

The data are listed in Table 1. It´s possible to say with a 95% of confidence that the real value is situated between the confidence limits listed in last two rows of Table 1. These was represented in the Figure 1.

**Figure 1. Confidence Intervals of Monthly Medias**  
(NO<sub>x</sub> en Microgrs/m<sup>3</sup> of Air)



These intervals will be followed analyzing in a cycle of ten years to determine the trends of the concentrations of NO<sub>x</sub>.

A quick overview can be seen in Table 2 where data was arranged in the percentile form.

**Table 2. Percentiles of NO<sub>x</sub> Values During 1995**  
(Micrograms/m<sup>3</sup> of Air)

Percent.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10	16	34.5	19	44	60	80	42.5	58	85	110.5	96	114
25	28.5	43	42	64.5	68	95.5	53	82.5	87	117	107.5	129
50	41	54	55	89.5	96	118	77.5	126	114	140	160	155
75	72	71	77	128.5	144.5	171	102	159.5	132.5	173	197.5	197
90	79	83.5	109.5	156.5	183	191	121	204	134	189	270.5	217

**INTERPRETATION:** String 1, January

10% of the values of NO<sub>x</sub> is inferior or equal to 16 Micrograms / m<sup>3</sup> of air.

**CONCLUSION:**

Analyzing the data obtained during the year 1995 (Table 1), it can deal a growing trend in the concentrations from NO<sub>x</sub> along the year. The motive of this trend, we suspect belongs to the increase in the frequency to convey in the zone of the commercial center of the city (place where it is located the sampling station), and in addition to an exceptional climatic condition in the second semester of the year, where prevailed conditions (rain absence and calm winds), being opposed to the characteristic normal conditions of this zone and that possesses good rain regime and strong winds in some months.

Currently we are in the task of contrasting pollution data with other parameters as are the meteorological variables, evolution of the vehicular flow, incidence of other sources.

We wait with the advance of these studies - bases on the task that effect the forefront countries -, to offer a tool to help the preservation of the environmental in our city, and offer usefulness data to other institutions that need it.