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# Air Pollution - The Old Problem of Bacau Municipality

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**Abstract:** Following the evaluation of air quality at national level, the municipality of Bacau falls under the management regime I. The evaluation of air quality was carried out both by measurements at fixed points, with the help of measuring stations that are part of the National Air Quality Monitoring Network, central public authorities for environmental protection, as well as based on the results obtained from the mathematical modeling of the dispersion of pollutants emitted into the air. The main sources of air pollution in Bacau are represented by combustion in the energy sector, production processes, road traffic and individual heating systems. These sources require continuous monitoring to find the best possible techniques for minimizing and reducing the amount of pollutants released into the atmosphere. Emissions of nitrogen oxides (NOx) on the territory of Bacau municipality are released into the atmosphere especially in urban areas (inhabited areas) and on industrial platforms. Once released into the air, pollutants, due to the dispersion phenomenon, can be transported to different areas depending on the weather conditions present. The unfavorable combination of dispersal, weather conditions, topography of the region and pollutant concentrations can lead to exceeding limit values, with negative effects on human health.

**Keywords:** Environment, Pollution, Atmosphere, Pollutants, Emissions, Transport

## 1. Introduction

Whether direct or indirect, intended or accidental, pollution of the environment is a reality of our present. It is manifested by the most dramatic consequences. Much too often, the severity of these consequences is so great that we wonder whether we humans are capable of being aware of it. It is obvious that in the process of their evolution, man has accumulated information that has allowed him to form and develop ecological consciousness, that is the belief that the insignificant, but complex humanity belongs as a system of systems to the macro system of systems that is NATURE, and the impact of ecological awareness has led to the development of a number of laws, which demonstrates the reciprocity of the consequences of human actions. Thus the law that states that ”everything is related to everything else” demonstrates that in nature, biological systems are not isolated, but integrated into the environment, the law “everything must go somewhere” shows that from an ecological point of view nothing is useless; there are no wastes, but they are useful to other organisms, the law “nature knows best” says that any major human intervention in ecosystems is harmful, and the law ”there is no such thing as a free lunch” stated by Mitscherlich in 1930, argues that the improper and irrational exploitation of the environment leads to the disorganization of the system without returning the extracted components because everything is cohesive.

## 2. Material and Methods

The evaluation of the activities according to the environmental permits in force for the economic operators from Bacau municipality represented a first step in identifying the fixed sources of nitrogen oxides (NOx) emission. [1] The local emission inventories represented the source of quantitative and qualitative information on the categories of emission sources and the quantities of nitrogen oxides (NOx) emitted on the administrative territory of Bacău municipality, in the time period 2019-2021, the reference year being 2020. [2] The local ILE emissions inventory associated with Bacau County includes all categories of emission sources and generated air pollutants. In the inventory for the applicability within the Air Quality

Plan, only data regarding the emission sources for nitrogen oxides (NOx) located in Bacau municipality, structured on the following categories of sources, were interrogated:

1. Fixed sources - are represented by individual or common fixed sources represented mostly by installations of authorized economic operators from the point of view of environmental protection; these emissions are represented by the combustion of fuels (solid, liquid, gaseous) in thermal power plants and industrial boilers being present mainly on the industrial platforms of Bacau municipality.
2. Surface sources - are represented by diffuse (undirected) sources of pollution smaller or more distributed on a land surface;
3. Linear sources of emissions from road, rail and air transport.

Following the need to monitor the dispersion of pollutants, according to the European Environment Protection Agency, 142 dispersion models accepted at EU level have been proposed, all with a common goal: to reduce pollution globally. [3] As a result of the location of the emission sources in Bacau, the assessment of air quality in Bacau was done through monitoring stations, but also by using a mathematical model of dispersion based on measured values of pollutants at sources, specific emission factors, of the geographical distribution of the sources and of the meteorological conditions of propagation of the emissions, as a result of the location of the emission sources at the level of Bacau municipality. The mathematical dispersion model is used to determine the exposure level on a larger scale, this is not obtained exclusively from measurements. Atmospheric dispersion refers to the evolution in time and space of a set of pollutants (aerosols, gases, particles) emitted into the atmosphere. The phenomenon of atmospheric dispersion is influenced by atmospheric conditions, soil parameters and emission values. The atmospheric dispersion model (MDA) is the mathematical simulation of the distribution of pollutants in the atmosphere and is a forecast of the concentration of air pollutants at the receivers depending on the location of emission sources, type and quantities of pollutants emitted, topographic, meteorological conditions, etc. [4]

## 3. Results and Discussions

Unfortunately, urban areas are severely affected and fully support the process of permanent degradation, a process due to industrial, noise, urban, household, aesthetic pollution, and this situation directly affects the quality of urban life and thus the health of the population. If the air we breathe is degraded, severely affected, the very development and evolution of society within an urban ecosystem is endangered. [5] Therefore, it is necessary to study the ways in which a qualitative balance can be established between the level of air degradation due to anthropogenic polluting activities and ensuring favorable conditions. Occupying a leading place on the list of the most polluted cities, for the city of Bacau is worrying is the contamination of air with polluting gases and even ultrafine particles produced by engines, transport being the main cause of contamination, and exhaust gases being leading among pollutants.

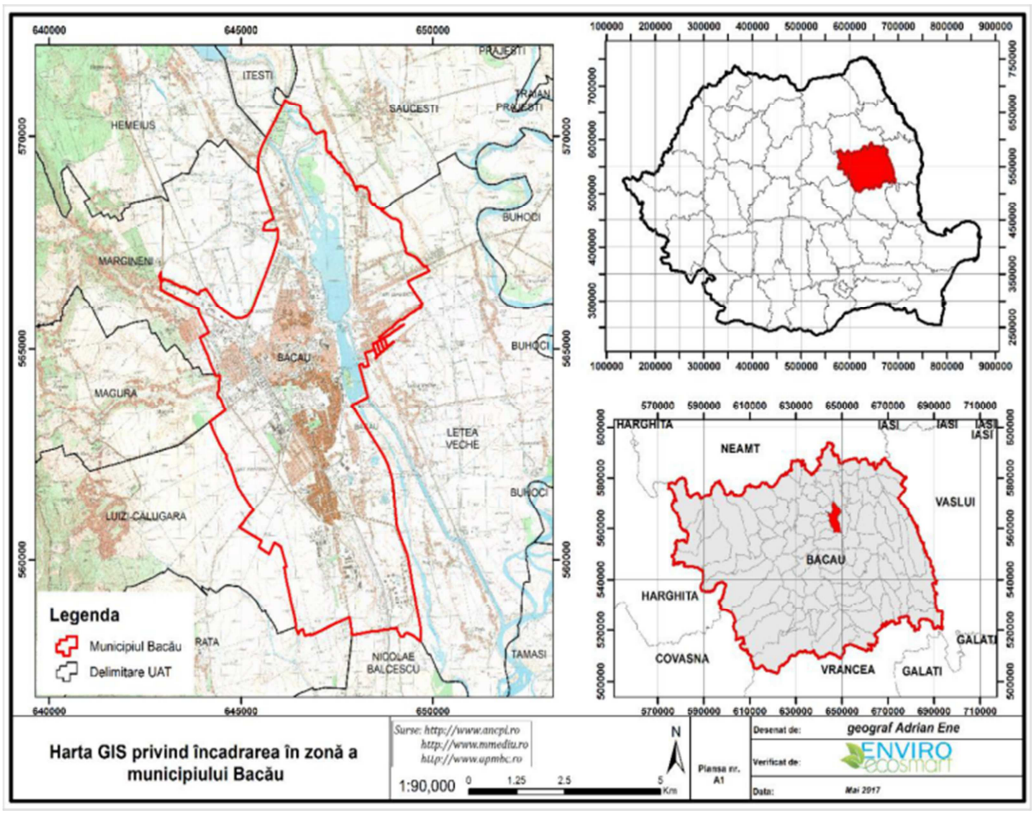


***Figure 1.*** *Location of Bacau municipality- taking over according to the Air Quality Plan in Bacau municipality.*

General considerations

Located at the intersection of the meridian of 26°55 'east longitude with the parallel of 46°35' north latitude, the city of Bacau occupies an area of 4319 ha. From the administrative point of view, it borders the communes of Hemeiuș and Săuceşti, in the north, with the commune of Letea Veche, in the east, in the south with the communes of Luizi-Calugara, Magura and Margineni. [6]

The general circulation of the atmosphere takes place in the NW-SE and N-S direction, depending on the orientation of the valleys and suffers a series of influences, the most important factors to mention being:

1. the width and orientation of the Siret and Bistrita valleys,
2. the structure and type of terraces and the structure of Siret and Bistrita,
3. the vicinity of Pietricica Peak in the south,
4. the asymmetrical character of the Siret valley;

These elements contribute decisively to the dispersion of pollutants; Depending on temperature (atmospheric stability / instability), pressure, density, humidity, wind and atmospheric turbulence, pollutant emissions can be displaced by the wind in a direction or other, may stagnate in the residential area of the city, may be transported long distances from the source or may be deposited. [7] Documentary evidence of over six centuries, the city of Bacau is at the crossroads of European roads, being located on the most important trade route of Moldova - the Siret road, which connected Lviv and other economic centers in northern Europe with the southern Danube. [8] The settlement was attached to a ford of Bistrita, close to its outflow, namely where the river was cut by a branch of the great transcontinental road which - starting from the Danube - went up Siret, up to Poland. We will further follow the connection between the main meteorological factors and the dispersion of pollutants in the atmosphere.

The report published by APM Bacau shows in detail the evolution of air pollution in the last year compared to 2015-2020. Compared to the previous year, in 2021 there were slight increases in annual averages for nitrogen dioxide, sulfur dioxide and carbon monoxide. Pollution from ammonia and gas from the exhaust pipes of thousands of cars circulating through the city almost non-stop has also been reduced [6].

Thermoenergy S.A.Bacau continues to be the most important sulfur dioxide pollutant, even though the company reported an increase in the amount of natural gas used compared to the previous year and claims that it also used a higher amount of biomass. Instead of decreasing, sulfur dioxide pollution increased by about 6%. "The main source of emissions in the energy sector is Thermoenergy SA Bacau, with higher emissions than in the previous year", says Maria Ionos, ARPM Bacau advisor. [9]

The district heating company is also the most important source of emissions of monoxide and nitrogen dioxide. On the company's website the only environmental report is from 2010. Here is also a long list of waste produced as a result of the activity. These include tens of thousands of tons of slag and ash, kilograms of iron, oils, sludge and wastewater. [10]

The picture of pollution is completed by the lack of a ring road, a deficiency that makes all the traffic that could bypass the city actually pass through it. The level of pollutants is well above the legal limits. To this is added the lack of green space in the city, Bacau being - from this point of view - far below the regulations in force. This is the conclusion of ARPM Bacau following the report. [9]

Another old source of pollution is provided by agriculture. This was the help from which the highest amounts of ammonia emissions came in 2016. The main polluters in 2016 were Amurco, Avicola and Suinprod. The chemical plant has updated its technology, in support of the people of Bacau who have permanently complained about the episodes of ammonia pollution. If in 2015 there were 15 reports of ammonia odor, in 2016 their frequency decreased. "The last notifications were one in August and one at the beginning of September (2016), but it was against the background of special atmospheric conditions. Following the control carried out by the Environmental Guard, no malfunctions were found in the facilities, says the chief commissioner of the Environmental Guard. The main source of ammonia pollution turned out to be, in 2016, according to the same report, SC Avicola SA. Notifications regarding the unbearable smell from the poultry farm, came this time from the other end of the city, in the area of Gheraieşti neighborhood. In response to these complaints, controls were carried out, and they found that the company complied with the parameters set out in the integrated environmental permit. "No technology, no matter how advanced, can fix the odor problem," explained the head of the Environmental Guard. On the other hand, the chairman of the Agricola Group of Companies stated that “housing is too close. We have made efforts for the technology to be at European standards and we are open to find new solutions to remedy the situation ". He emphasizes, however, that those who build their houses on the farm gate cannot but assume responsibility for their decision.

The draft decision approved by the Bacău Local Council identifies the main polluter in the municipality: Thermoenergy S.A. (former CET SA). In order to reduce the district heating company's emissions, the municipality undertook to use biomass in the combustion from the district heating supplier and to reduce the amount of coal used in the production process of the heating agent. This, given that the commissioning of the famous cogeneration group the same mayors have promised that the level of pollution, as well as the cost will decrease significantly. Moreover, one of the biggest problems not solved by the City Hall is the slag stored in the dump of the CET (Figure 2). The wind, as well as the poor positioning of the dump, cause tons of dust to fall on the city. [11]

***Figure 2.*** *Slag dump from Bacau.*

Another factor that contributes to the increase in pollution is the lack of green spaces. If the green spaces are missing, the air we breathe is not quality either. APM measures daily air quality in Bacau through the six stations located in different parts of the city. It is calculated for indicators such as sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide and dust in suspension. The head of the Public Services Department of the City Hall said he was reserved about the chances of Bacău to meet European regulations on green space / capita. The requirements of the European Union impose 26 sqm of green space per capita, but in Bacău they do not exceed 18 sqm per capita. Efforts are being made to find solutions to this problem, but at the same time the current area is being reduced by changing its original destination. This happened just a short time ago when many trees were cut down on CaleaMarăşeşti to make way for a KFC restaurant. [12]

The Temperature

Depending on the height, so the pressure, the variation of the air temperature is an important factor in the movement of air masses and therefore in the spread of pollutants in the atmosphere. The magnitude of the variation in air temperature is called the vertical temperature gradient and is expressed by the ratio dT/dz, where T is the absolute temperature of the air, expressed in degrees Celsius, and z is the height, expressed in meters. Depending on the size of this gradient, several types of stratification of the atmosphere or its states can be distinguished.

1. Stability is characterized by lower temperature than the vertical gradient;
2. The indifferent or neutral state is characterized by a decrease in temperature with height, after an adiabatic relationship; there is no difference between the air in the mass of air subject to displacement and that in the surrounding atmosphere;
3. Instability is characterized by a decrease in temperature with a height higher than the vertical gradient. It is frequently performed on summer days, when the heating of the soil gives rise to a pronounced vertical mixture of ascending currents. The rising air mass cools and continues to move, being less dense than the surrounding atmosphere. In this case, it will be in a state of instability with the surrounding air and will favor the dispersion of harmful substances.
4. Thermal inversions are characterized by the fact that the air temperature increases with height (a negative vertical gradient).

Wind is the most important factor in the spread of pollutants. Their diffusion is directly proportional to the wind speed. [13]

The humidity of the air prevents the particles from moving and opposes the dispersion of pollutants and the decrease of their concentration. Increased humidity leads to the formation of fog, which has the effect of concentrating impurities; In polluted areas, fog forms quite frequently. The suspended particles become condensation nuclei, and the fog can appear at a humidity of 70% (if there are more than 300-500 condensation nuclei / $cm^3$). Occupying the lower layers of the atmosphere, fog causes increased concentrations of pollutants, becoming an active factor in achieving chemical reactions in the atmosphere. Only when precipitation occurs is it washed to wash and dissolve impurities and bring them to the ground. The rain cleanses the atmosphere, especially of gases, and the snow of suspended solid particles.

The correlation of these three main factors and their application to the special conditions of the Bistrita-Siret confluence area, can lead us to the conclusion that, in the area of Bacau, in the conditions of an atmospheric instability present most of the year and taking into account the orientation of the slopes. two valleys, the dispersion of the pollutants is relatively efficient, in the north-west, south-east or south directions, without seriously affecting the residential areas.

Socio-economic Development of Bacau Municipality

From an economic point of view, Bacau is characterized by a high degree of industrialization and a highly developed transport network, which includes both road and rail transport and air transport. The industrial branches present in the economy of Bacau, with harmful effects on air quality, are: the electricity production industry (thermal power plant - Thermoenergy), the chemical industry (with the sub-branch producing chemical fertilizers based on nitrogen - Sofert SA), the food complex zootechnical "Agricola International"), to which are added the particularly intense road traffic and the burning of various fuels, in a multitude of technological processes.

The most common noxious substances released in the city's atmosphere are:

1. $SO_2$ - Thermoenergy S.A. Bacau (former CET S.A. Bacau);
2. $NO_x$ – Sofert S.A. plus road, rail and air traffic;
3. CO - combustion in all industrial installations and waste incineration;
4. $CO_2$ - Thermoenergy S.A., SUINPROD, plus fuel combustion;
5. $CH_4$ - Agricola International;
6. Hydrocarbons - traffic;
7. $NH_3$ - agriculture, Sofert S.A.

At the level of the Bacau aglomeration, there are two air quality monitoring stations, out of the three stations located in Bacău County. The data on air quality recorded by the

above mentioned stations are transmitted online on the website www.calitateaer.ro. The data are certified by the Air Quality Assessment Center of the National Agency for Environmental Protection.

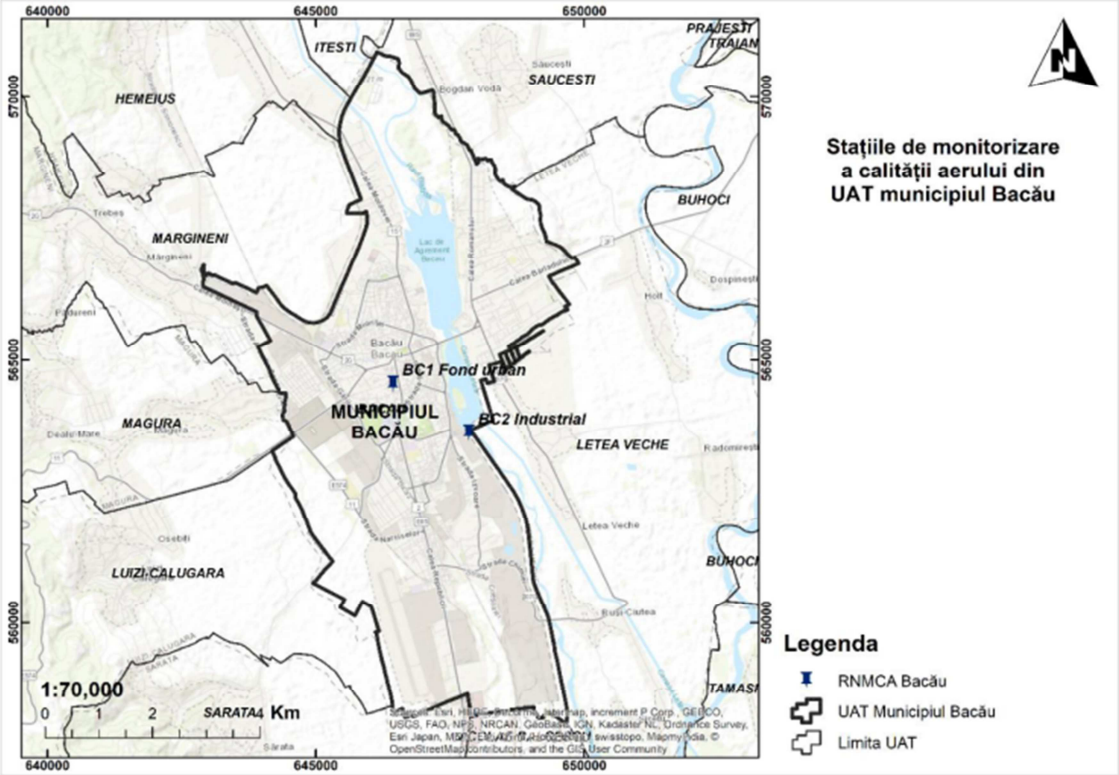


***Figure 3.*** *Location of air quality monitoring stations in Bacau.*

The monitoring system allows local authorities for environmental protection:

1. to constantly evaluate, know and inform the public, other authorities and interested institutions, about air quality;
2. to take, in due time, prompt measures to reduce or eliminate pollution episodes;
3. to prevent accidental pollution;
4. to warn and protect the population in case of emergency.

In an interview given in January 2019 to Deferlari journal, the researcher Alexandru Banica made an extremely interesting remark, namely "I can only love Bacău without feeling a perpetual dissatisfaction, close to adversity towards its present physiognomy." [14]

## 4. Conclusions

Under the impact of ecological awareness, a series of laws have been developed, which demonstrate the reciprocity of the consequences of human actions. Thus, the law "all are related to all", demonstrates that in nature biological systems are not isolated, but integrated into the environment, the law "everything must go somewhere" shows that from an ecological point of view nothing is superfluous; there is no residue / waste, but they use other organisms, the law "nature knows best" states that any major human intervention in ecosystems is harmful, and the law "nothing can be obtained in vain" stated in 1930 by Mitscherlich claims that the improper and irrational exploitation of the environment leads to the disorganization of the system without the return of the extracted components because everything is cohesive.

## References

[1] Air quality plan in Bacau municipality, p 14-16.

[2] Air quality plan in Bacau municipality, p 27-28.

[3] EUROPEAN TOPIC CENTRE ON AIR QUALITY - Ambient Air Quality, Pollutant Dispersion and Transport Models http://www.eea.europa.eu/publications/92-9167-028-6.

[4] Air quality plan in Bacau municipality, p. 44.

[5] Tita, Mihaela Cosmina, (2012) - Modeling the atmospheric dispersion of pollutants, University of Craiova, AGIR Bulletin, Supplement 2/2012.

[6] Popa, I., (2003) Atmospheric pollution in Bacău. Investments and Perspectives, Annals of Valahia University, Targoviste, Geography Series, Volume 3, 127-133.

[7] Air quality plan in Bacau municipality, p 22.

[8] Gregory. I., (2017), A history of the city of Bacău. Monograph 1928, Bacău, Babel Publishing House, p. 23.

[9] Giurăscu, C. C., (1967), Fairs or medieval towns and cities (From the 10th century to the middle of the 16th century), Bucharest.

[10] Vos, P. E. J. et al, (2013), Environmental Pollution, 183, 113-122.

[11] Buccolieri, R. et al, (2009), Science of The Total Environment, 407, 5247-5256.

[12] Pope, C. A. et al, (1995), Environmental Health Perspectives, 103, 472-480.

[13] Räsänen, J. V. et al, (2013), Environmental Pollution, 183, 64-70.

[14] Serban, L., (2019) Deferlari. http://www.deferlari.ro/,(The city with the red dot, http://www.deferlari.ro, by Lucian ?erban}