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Environmental noise pollution of urbanized areas on the example of Taganrog

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doi: 10.18411/trnio-11-2021-65

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Abstract

The article considers the significant problem of noise pollution in urbanized areas using the example of Taganrog in the Rostov region in the Russian Federation, emphasizes the importance of identifying the threat of the negative impact of noise pollution in the field of public health, clarifies the definition of the term "noise pollution". The paper analyzes the features of noise changes and gives a hygienic assessment of noise pollution in various urban territorial zones.

Keywords: noise, sound, health, noise pollution, man, environment, noise sickness.

Аннотация

В статье рассматривается значимая проблема шумового загрязнения урбанизированных территорий на примере города Таганрог Ростовской области в Российской Федерации, подчёркивается значимость выявления угрозы негативного воздействия шумового загрязнения в сфере общественного здравоохранения, уточняется определение термина «шумовое загрязнение». В работе анализируются особенности изменения шума и дана гигиеническая оценка шумового загрязнения в различных городских территориальных зонах.

Ключевые слова: шум, звук, здоровье, шумовое загрязнение, человек, окружающая среда, шумовая болезнь.

Introduction. Today, noise pollution is increasingly having a negative impact the environment, as well as on human health and life. Studying the nature of sound, one should distinguish between such sounds as tones or (musical sounds), noises, and sound beats. Noise is a sound characterized by a complex non-repeating time dependence [1].

Noise pollution is understood as annoying anthropogenic noise that exceeds the natural level of natural background noise [3]. At the moment, all types of transport are considered to be the main sources of noise in cities. Additional sources of increased background noise are also should be taken into account. Among them, construction sites, road construction, and repair work, noise from infrastructure facilities, and other sources of noise caused by the human activity should be viewed as the important ones. It is known that the comfort level is up to 30 dB, the permissible level is from 30 dB to 60 dB, and the dangerous level is from 60 dB and above.

The aim of the study is to assess the noise pollution of urbanized areas of the city. Let's consider the problem of noise pollution by the example of Taganrog.

Research methodology. Noise measurements were carried out using a MEGEON-92130 digital sound level meter. For measurements were selected areas for various purposes, such as

recreational areas, industrial areas, areas of engineering and transport infrastructure, public and residential areas. During the measurements, the meteorological conditions of the environment (wind speed, air temperature, humidity, atmospheric pressure) were taken into account [4].

Noise measurements were carried out in various areas. The locations for the measurements were chosen so that it was possible to compare the noise level in the center and around the perimeter of the city.

Recreational area. Recreational land includes land plots on which there are rest houses, boarding houses, campings, physical culture, and sports facilities, tourist centers, stationary and tent tourist and recreational camps, children's tourist stations, tourist parks, educational and tourist trails, trails, children's and sports camps, other similar facilities.

Measurement number	Amount of points	The date of the	Measurement location address	Wind speed (m/s)	Air temperature (°C)	Humidity (%), no more than 80%	Atmospheric pressure (mm Hg)	Maximum value of noise level (dB)	Average noise level (dB)	Minimum noise level (dB)	Measurement duration at one point, min
Recreational areas											
1	1	25.01.2021	Komsomolsky square, Taganrog, Rostov region, 347922	2	plus 3	79	760	93.1	67.5	53.2	3
	2			2	plus 3	79	760	68.4	59.5	50.7	
	3			2	plus 3	79	760	69.7	59.0	48.8	
	4			2	plus 3	79	760	67.8	60.5	52.5	
	5			2	plus 3	79	760	72.1	63.7	55.8	
2	1	25.01.2021	Pushkinskaya embankment, Taganrog, Rostov region, 347922	2	plus 6	74	760	72.8	62.3	51.8	3
	2			2	plus 6	74	760	78.5	66.5	54.5	
	3			2	plus 6	74	760	73.6	61.9	50.1	
	4			2	plus 6	74	760	70.8	59.8	48.4	
	5			2	plus 6	74	760	78.9	65.1	55.0	
3	1	16.02.2021	Park of culture and rest, Petrovskaya st., 104, Taganrog, Rostov region	5	minus 4	53	766	69.6	60.9	52.7	3
	2			5	minus 4	53	766	70.8	59.9	48.1	
	3			5	minus 4	53	766	72.7	59.1	47.2	
	4			5	minus 4	53	766	64.8	56.7	47.8	
	5			5	minus 4	53	766	67.3	62.6	56.4	
4	1	16.02.2021	October Square, Taganrog, Rostov Region, 347922	5	minus 4	54	767	67.1	60.6	52.0	3
	2			5	minus 4	54	767	66.1	58.3	49.8	
	3			5	minus 4	54	767	71.0	61.1	50.3	
	4			5	minus 4	54	767	67.0	59.5	50.9	
	5			5	minus 4	54	767	65.5	57.1	48.4	
5	1	20.02.2021	Seaside park, Taganrog, Rostov region 347923	1	minus 2	62	774	63.5	58.1	55.5	3
	2			1	minus 2	62	774	74.1	61.4	46.4	
	3			1	minus 2	62	774	71.7	61.4	46.2	
	4			1	minus 2	62	774	72.5	59.3	46.2	
	5			1	minus 2	62	774	70.7	60.9	49.2	

Picture 1. Protocol of measurements for the recreational area

Based on the data obtained, it can be concluded that the average noise level of the surveyed areas is dangerous. Since these territories are located in the central part of the city, it can be assumed that the main sources of noise are the main streets with a large traffic flow during the day. Also, one of the reasons for noise pollution in this area may be the lack of a sufficient number of green spaces, which serve as a “barrier” by shortening sound waves with the help of leaves.

Industrial zones, zones of engineering, and transport infrastructures. Industrial zones, zones of engineering and transport infrastructures are intended for the placement of industrial, utilities and storage facilities, objects of engineering and transport infrastructures, including structures and communications of railway, road, river, sea, air and pipeline transport, communications, as well as for the establishment of sanitary protection zones of such facilities in accordance with the requirements of technical regulations. [8]

Measurement number	Amount of points	The date of the	Measurement location address	Wind speed (m/s)	Air temperature (°C)	Humidity (%), no more than 80%	Atmospheric pressure (mm Hg)	Maximum value of noise level (dB)	Average noise level (dB)	Minimum noise level (dB)	Measurement duration at one point, min
Industrial zones, zones of engineering and transport infrastructures:											
6	1	25.01.2021	Taganrog Commercial Sea Port, st. Komsomolsky descent, 2, Taganrog, Rostov region	6	plus 4	73	760	81.8	67.7	53.5	3
	2			6	plus 4	73	760	72.6	59.5	50.3	
	3			6	plus 4	73	760	74.1	60.5	48.8	
	4			6	plus 4	73	760	73.6	60.9	47.7	
	5			6	plus 4	73	760	71.8	62.6	53.4	
7	1	20.02.2021	Taganrog Metallurgical Plant, Electric shop, Socialist street, 155, Taganrog, Rostov region	1	minus 4	67	773	79.0	62.6	55.4	3
	2			1	minus 4	67	773	69.5	62.0	54.6	
	3			1	minus 4	67	773	74.5	64.9	57.4	
	4			1	minus 4	67	773	68.9	67.5	64.8	
	5			1	minus 4	67	773	73.2	66.9	61.5	
8	1	20.02.2021	Taganrog Metallurgical Plant, Socialist Street, Taganrog, Rostov Region	1	minus 1	58	774	80.7	75.8	70.8	3
	2			1	minus 1	58	774	78.6	74.3	69.7	
	3			1	minus 1	58	774	79.3	75.0	71.4	
	4			1	minus 1	58	774	85.9	78.5	70.6	
	5			1	minus 1	58	774	79.9	74.5	70.8	
9	1	20.02.2021	Taganrog sausage factory, Socialist street, 152-4, Taganrog, Rostov region	1	minus 1	58	774	79.6	75.4	69.9	3
	2			1	minus 1	58	774	76.2	71.8	67.9	
	3			1	minus 1	58	774	77.1	71.1	68.2	
	4			1	minus 1	58	774	89.1	77.6	68.6	
	5			1	minus 1	58	774	78.1	73.4	68.6	

Picture 2. Measurement report for the industrial area (part 1)

10	1	27.03.2021	Station Taganrog- Passenger, st. Moskova, 8, Taganrog, Rostov region.	3	plus 4	73	763	74,6	68,2	63,8	3
	2			3	plus 4	73	763	75,1	70,1	65,2	
	3			3	plus 4	73	763	72,2	62,0	56,5	
	4			3	plus 4	73	763	65,6	53,9	51,6	
	5			3	plus 4	73	763	65,0	57,4	49,4	
11	1	20.02.2021	Taganrog railway station 2, pl. Vostaniya, 3, Taganrog, Rostov region.	1	minus 1	57	775	78,7	64,9	53,5	3
	2			1	minus 1	57	775	67,9	61,6	54,8	
	3			1	minus 1	57	775	79,6	69,4	56,9	
	4			1	minus 1	57	775	71,3	65,5	56,7	
	5			1	minus 1	57	775	71,4	63,7	55,6	
12	1	25.01.2021	Railway station Matsvevo, Kanavaya st., 2/1, Taganrog Rostov region, 347900	5	plus 4	73	758	70,9	59,8	48,4	3
	2			5	plus 4	73	758	71,8	61,2	50,6	
	3			5	plus 4	73	758	70,2	57,9	48,9	
	4			5	plus 4	73	758	76,7	62,8	50,7	
	5			5	plus 4	73	758	84,4	85,9	76,1	
13	1	20.02.2021	Rolled metal products, Polyakovskoe sh., 11, Taganrog, Rostov region.	1	minus 2	65	774	84,2	71,7	58,5	3
	2			1	minus 2	65	774	78,2	70,2	61,2	
	3			1	minus 2	65	774	74,4	64,7	55,6	
	4			1	minus 2	65	774	79,8	70,2	57,6	
	5			1	minus 2	65	774	76,8	67,88	56,6	
14	1	20.02.2021	Aviator Square, Taganrog, Rostov Region 347923	1	minus 2	64	774	71,4	65,2	60,6	3
	2			1	minus 2	64	774	70,0	60,4	51,9	
	3			1	minus 2	64	774	73,5	62,4	51,5	
	4			1	minus 2	64	774	76,2	67,8	56,1	
	5			1	minus 2	64	774	69,6	63,3	53,0	

Picture 3. Measurement report for the industrial area (part 2)

Taganrog is one of the industrial cities in the south of Russia. Manufacturing plays an important role in the city's industry. The following industries are developed in Taganrog: ferrous metallurgy, metalwork plants, mechanical engineering, transport engineering. In addition, there are dozens of small factories and small businesses in Taganrog: brick factories, a furniture factory, enterprises for the production of reinforced concrete products, and others. [7]

In this regard, the level of noise pollution in the production area is very high, as evidenced by the data obtained from the measurements. Average values of the noise level in the production and transport areas as well as in the recreational area is dangerous. These facilities of production, engineering, and transport infrastructure are dispersed in different areas and cause a lot of noise pollution throughout the city.

Public and business areas. Public and business zones are intended for the placement of health care, culture, trade, public catering, social and communal services, business activities, objects of secondary vocational and higher education, administrative, research institutions, religious buildings, parking lots for motor vehicles, business facilities, financial purposes, other objects related to ensuring the life of citizens. [8]

Measurement number	Amount of points	The date of the	Measurement location address	Wind speed (m/s)	Air temperature (°C)	Humidity (%), no more than 80%	Atmospheric pressure (mm Hg)	Maximum value of noise level (dB)	Average noise level (dB)	Minimum noise level (dB)	Measure ment duration at one point, min
Общественно-деловые зоны											
15	1	16.02.2021	ITA Southern Federal University, Nekrasovsky per., 73, Taganrog, Rostov region, 347922	5	minus 4	57	766	74,3	59,0	48,6	3
	2			5	minus 4	57	766	74,8	61,2	49,6	
	3			5	minus 4	57	766	72,4	65,5	58,5	
	4			5	minus 4	57	766	79,3	62,7	49,7	
	5			5	minus 4	57	766	72,6	62,7	53,4	
16	1	27.03.2021	TGPI them. A.P. Chekhova, Initiative st., 48, Taganrog, Rostov region, 347924	4	plus 6	68	763	69,7	60,1	49,6	3
	2			4	plus 6	68	763	70,1	60,1	49,3	
	3			4	plus 6	68	763	60,8	57,2	49,2	
	4			4	plus 6	68	763	67,4	58,4	49,0	
	5			4	plus 6	68	763	69,1	60,0	49,2	
17	1	16.02.2021	Administration of the city of Taganrog, Petrovskaya st., 73, Taganrog, Rostov region, 347900	5	minus 4	53	766	74,3	64,7	59,0	3
	2			5	minus 4	53	766	71,1	65,7	58,1	
	3			5	minus 4	53	766	76,4	66,3	55,5	
	4			5	minus 4	53	766	80,5	71,8	53,9	
	5			5	minus 4	53	766	73,1	64,5	53,5	
18	1	20.02.2021	Hypemarcet "Lenta", st. 2nd Soviet, 74B, Taganrog, Rostov region, 347930	2	minus 1	64	773	83,5	68,9	58,1	3
	2			2	minus 1	64	773	79,9	64,9	53,2	
	3			2	minus 1	64	773	71,0	63,3	55,1	
	4			2	minus 1	64	773	76,5	66,8	50,2	
	5			2	minus 1	64	773	75,6	66,2	57,2	
19	1	16.02.2021	TC "Leto", st. Syzranova, 11, Taganrog, Rostov region, 347939	5	minus 4	54	764	72,5	65,1	58,9	3
	2			5	minus 4	54	764	76,7	67,2	58,9	
	3			5	minus 4	54	764	76,7	67,0	58,1	
	4			5	minus 4	54	764	82,1	70,0	57,1	
	5			5	minus 4	54	764	81,5	65,6	55,6	
20	1	27.03.2021	Gogolevsky lane, 4A, Taganrog, Rostov region, 347900	3	plus 5	67	763	68,8	57,9	48,5	3
	2			3	plus 5	67	763	67,6	48,5	48,9	
	3			3	plus 5	67	763	65,1	61,3	52,7	
	4			3	plus 5	67	763	68,9	62,2	54,9	
	5			3	plus 5	67	763	79,1	72,8	65,4	

Picture 4. Protocol of measurements for public and business areas

Measurements of the noise level showed that the highest noise level in these areas reaches 83.5 dB, and the lowest value is 48.5 dB. On average, the noise level in a public business area range from 60 dB to 72 dB. This noise level is hazardous.

Residential areas. Residential zones may include development zones for individual residential buildings; development zones for individual residential buildings and low-rise residential buildings of blocked development; development zones with mid-rise residential buildings of block buildings and apartment buildings; building zones with multi-storey apartment buildings; residential areas of other types.

Measurement number	Amount of points	The date of the	Measurement location address	Wind speed (m/s)	Air temperature (°C)	Humidity (%), no more than 80%	Atmospheric pressure (mm Hg)	Maximum value of noise level (dB)	Average noise level (dB)	Minimum noise level (dB)	Measurement duration at one point, min
Residential areas											
22	1	16.02.2021	Residential area, st. named after Sergei Shilo, 200, Taganrog, Rostov region, 347939	5	minus 4	54	764	63,7	55,1	48,1	3
	2			5	minus 4	54	764	68,5	57,3	49,6	
	3			5	minus 4	54	764	65,9	56,8	47,7	
	4			5	minus 4	54	764	75,6	61,2	47,8	
	5			5	minus 4	54	764	72,4	61,2	49,4	
23	1	27.03.2021	Residential area, st. Marshal Zhukov, 1E, Taganrog, Rostov region, 347942	2	plus 4	75	763	67,0	58,8	51,6	3
	2			2	plus 4	75	763	66,5	58,8	48,9	
	3			2	plus 4	75	763	68,9	59,9	49,5	
	4			2	plus 4	75	763	66,4	61,4	54,3	
	5			2	plus 4	75	763	68,6	58,2	47,8	
24	1	27.03.2021	Residential area, Nekrasovskiy per. 48, Taganrog, Rostov region, 347922	3	plus 4	67	762	67,1	59,6	52,0	3
	2			3	plus 4	67	762	65,8	58,9	50,4	
	3			3	plus 4	67	762	65,7	59,1	51,7	
	4			3	plus 4	67	762	67,0	61,1	53,9	
	5			3	plus 4	67	762	69,1	64,3	58,7	
25	1	27.03.2021	Residential area, 1st Novy per., 26, Taganrog, Rostov region.	4	plus 6	75	764	66,0	56,4	45,9	3
	2			4	plus 6	75	764	51,0	48,6	54,5	
	3			4	plus 6	75	764	59,3	52,8	48,1	
	4			4	plus 6	75	764	62,6	54,2	45,7	
	5			4	plus 6	75	764	60,3	54,0	47,4	
26	1	16.02.2021	Student residential complex, Turgenevskiy per., 44A, Taganrog.	5	minus 4	56	767	81,5	66,9	50,6	3
	2			5	minus 4	56	767	71,7	61,5	50,6	
	3			5	minus 4	56	767	75,2	63,2	51,2	
	4			5	minus 4	56	767	77,3	63,9	50,7	
	5			5	minus 4	56	767	76,5	67,2	58,4	

Picture 5. Protocol of measurements for residential areas

If we compare residential areas with each other, then the noisiest areas include Student residential complex, Turgenevsky per., 44A, as well as Residential area, Nekrasovskiy per. 48. The rest of the regions have a noise level approximately within the same limits. Based on the data obtained, it can be concluded that the noise level in residential areas located in the city center is not much, but still higher than in residential areas located on the outskirts. In general, the noise level in residential areas can be considered acceptable.

Conclusion. It should be mentioned that the study revealed that the territory of Taganrog has a high noise load, which has a negative impact on the health and psycho-emotional state of the population, as well as on the viability of animals, birds, and fish. This situation requires the adoption of measures to reduce the noise load, the search, and selection of optimal noise protection measures.

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