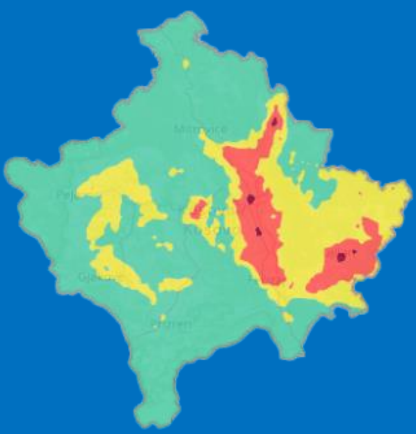
Republic of Kosovo

Ministry of Environment, Spatial Planning and Infrastructure



ANNUAL REPORT ON THE STATE OF THE AIR 2022

AMMK

Introduction

The annual report on the state of the air in Kosovo for 2022 provides a summary of data on air quality, air emissions, legal and institutional infrastructure, as well as recommendations for improving the situation.

The assessment of the state of air quality was made based on the data collected from all air quality monitoring stations, located in the territory of the Republic of Kosovo. Air quality monitoring was done at 12 stations, and data on pollutant indicators were collected from 60 instruments.

While within the data on air emissions, have been presented only the data reported by some industrial operators, who have reporting obligations, based on the instruction for air emissions, for stationary sources and the conditions of the relevant environmental permits.

The data presented in the report have been collected by: the Hydro- meteorological Institute of Kosovo as an institution that monitors air quality, other relevant institutions, economic operators, as well as from other projects in the air sector, implemented by institutions or donors during 2022.

The collected data has been processed and evaluated by the Environmental State Assessment Sector, in the Environmental State Assessment Directorate of the Kosovo Environmental Protection Agency.

The data presented in the report on the state of air quality, are for 5 pollutants:

- Carbon monoxide (CO),
- Ozone (O_3),
- Sulfur Dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Dust particles smaller than 10 and 2.5 microns in diameter, respectively PM_{10} & $PM_{2.5}$.

Whereas data on air emissions include estimates for air emissions of: NOx, SO_2 and Total Dust from economic operators: TCA and TCB, New Co Ferronickel and SharrCem.

The Contents

1. Legal infrastructure of the air

1.1. The legal framework

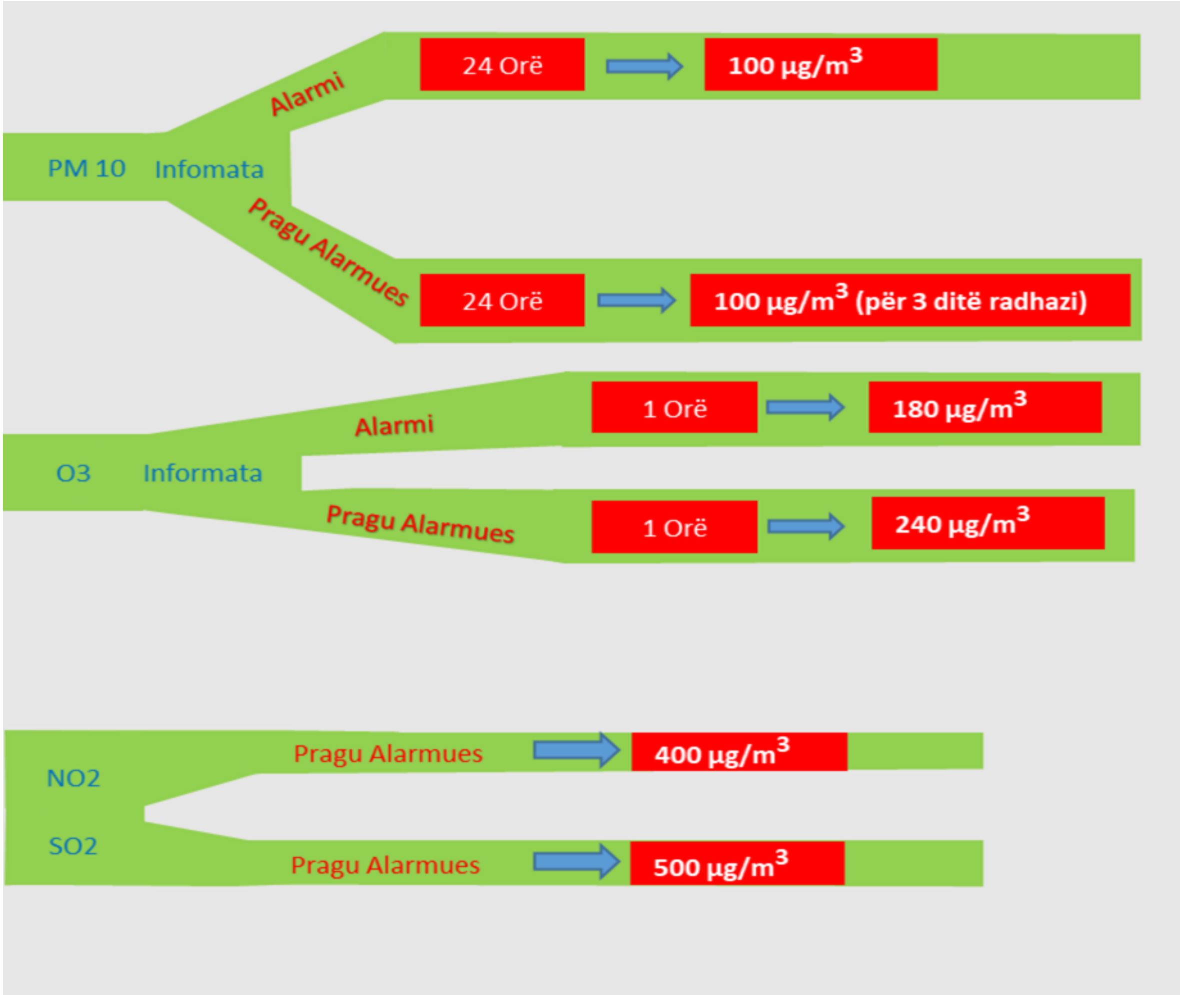
Law on air pollution protection LAW NO. 08/L-025, 2022 is the basic law for air pollution protection.

The legal infrastructure for the protection of air from pollution is also supplemented by AI (sub-legal acts), such as:

- ✓ Administrative Instruction (GRK) – No. 07/2021) on the rules and rates of air emissions from stationary sources of pollution;
- ✓ Administrative Instruction (GRK) No. 04/2009) for the control of emissions of evaporating organic compounds during fuel storage, emptying, filling and transportation;
- ✓ Administrative Instruction (minister of MESP) No. 02/2011 on air quality standards;
- ✓ Administrative Instruction-No. 15/2010 on the criteria for determining the monitoring points for air quality, the number and frequency of measurements, the classification of pollutants that are monitored, the work methodology, the form and time of data reporting;
- ✓ Administrative Instruction (GRK)-No. 21/2013 on arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in the air;
- ✓ Administrative Instruction (GRK) No. 16/2013 on substances that damage the ozone layer and fluorinated greenhouse gases;
- ✓ Administrative Instruction (GRK)-No. 19/2013 for access to information on economic fuel consumption and CO2 emission of new personal vehicles;
- ✓ Administrative Instruction (GRK)-No. 01/2016 for the mechanism of tracking greenhouse gas emissions;
- ✓ Administrative Instruction (GRK) - No. 08/2016 on the permitted air emission rates from mobile sources of pollution.

1.2. **Alarm limits for air quality**

Alarm limits for air quality pollutants are determined according to the Law on Air Pollution Protection LAW NO. 08/L-025, 2022, and UA 02/2011 for Air Quality Standards. (Fig.1).



Air quality standards according to AI No. 02/2011, and the Air Quality Index can be found in the annexes of this report.

1.3. Air pollutants

Carbon monoxide (CO)

CO is released whenever fuels or other carbon-based materials are burned. Sources of external exposure include emissions from road transport, and industrial processes (metal processing and chemical production). Natural sources include volcanoes, forest fires, and photochemical reactions in the atmosphere.

Indoor sources of exposure include: fireplaces, continuously burning gas leaks, gas or kerosene heaters, and cigarette smoke. See fig.2.

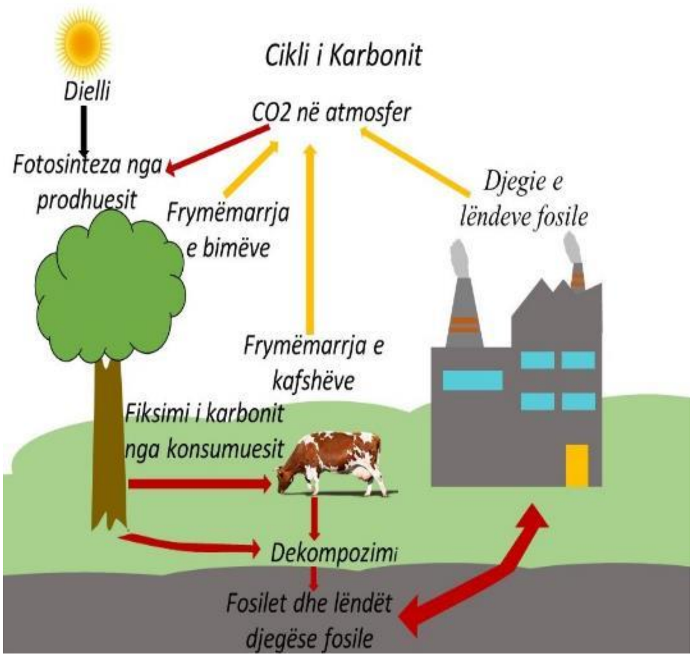


Fig.2. The carbon cycle

The toxic effects of high concentrations of CO on the body are well known. Carbon monoxide is absorbed from the lungs and reacts with hemoglobin (the oxygen-carrying molecule in the blood) to form carbo-oxyhemoglobin (COHb). This reaction reduces the blood's capacity to carry oxygen, because hemoglobin's affinity for CO is over 200 times more than that for oxygen. The higher the percentage of hemoglobin bound in the form of carbo-oxyhemoglobin, the more serious the health effect is.

The level of COHb in the blood is directly related to the concentration of CO in the inhaled air. This level of COHb will be maintained in the blood as long as the level of CO in that environment remains unchanged, but that this level of COHb will slowly change in the same direction as the concentration of CO in the ambient air.[1]

People at risk: are people with cardiovascular (heart and respiratory) diseases, babies, the elderly, pregnant women, etc. However, elevated CO levels can also affect healthy people.[2]

[1] State of Illinois/ Illinois Environmental Protection Agency-Air quality report, 2020
[2] MESPI/KEPA- Air quality report 2021

Nitrogen dioxide (NO_2)

Nitrogen gas (N_2) is an abundant and inert gas that makes up 79% percent of the Earth's atmosphere.

In this form, it is harmless to humans and essential for plant metabolism.

Because of its abundance in air, it is a frequent reactant in many combustion processes.

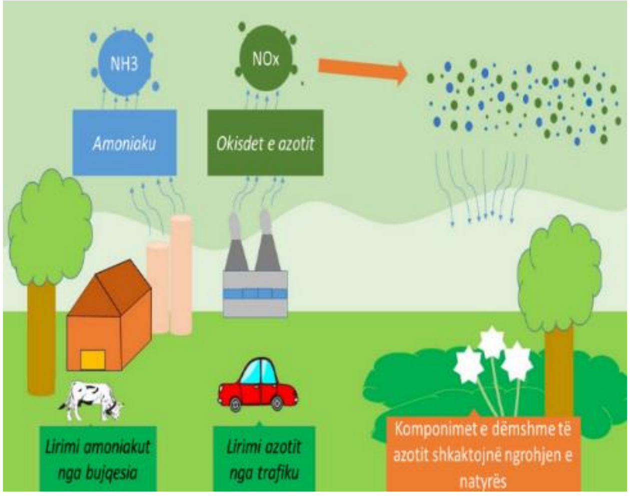


Fig.3. Sources of NO_2

When combustion temperatures are extremely high, as in burning coal, oil, natural gas, and gasoline, atmospheric nitrogen gas can combine with molecular oxygen (O_2) to form various oxides of nitrogen (NOx). Of these, nitric oxide (NO) and nitrogen dioxide (NO_2) are the most important contributors to air pollution; NOx is generally used to represent these.

Nitric oxide is a colorless and odorless gas. It is the main form of NOx resulting from the combustion process. NOx contributes to reduced fog and visibility. NOx is also known to cause deterioration and fading of certain fabrics and damage to vegetation (fig.3).

Depending on the concentration and extent of exposure, plants may experience leaf lesions and reduced crop yield.

The sensitivity of plants to NOx depends on a number of factors including species, time of day, light, stage of maturity and the presence or absence of other air pollutants such as sulfur dioxide and ozone.

NO_2 is a secondary derivative of atmospheric nitric oxide, however, it has been clearly proven to have harmful effects on human health and well-being.

NO_2 can cause eye irritation at concentrations as low as 0.07 ppm. NO_2 can cause airway irritation, increased respiratory rate, increased sensitivity to Broncho-constrictors, decreased lung compliance, and increased susceptibility to respiratory infections. NO_2 is a profound lung irritant capable of producing pulmonary edema if inhaled in sufficient concentrations. When NO_2 is absorbed in concentrations with other pollutants, then it has additive effects.[3]

[3] State of Illinois/ Illinois Environmental Protection Agency-Air quality report, 2020

Sulfur dioxide (SO_2)

High and short-term concentrations of SO_2 in the environment cause irritation in the respiratory organs. When fuel containing sulfur is burned, the sulfur is oxidized to form SO_2, which then reacts with other pollutants to form aerosols.[4]

Coal-burning power plants are the largest source of SO_2 emissions. Other sources include industrial processes such as the extraction of metals from ores, non-road transport and natural sources such as volcanic sources of SO_2, as well as other particulates that are often co-emitted. (fig.4).

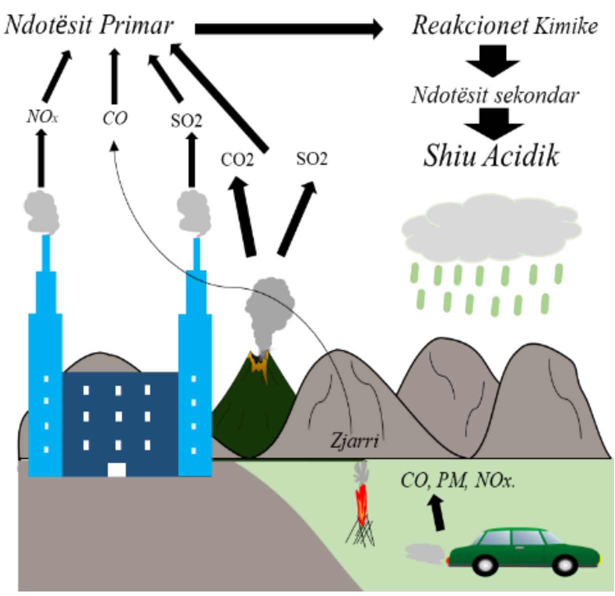


Fig.4. Sources of SO_2

Effects: Exposure to elevated levels can worsen symptoms in asthmatics and cause breathing problems in people. SO_2 and NOx together are the main precursors of acid rain and are associated with acidification of soils, lakes and streams, as well as accelerated corrosion of buildings and monuments.

Persons at risk: Asthmatics, children and the elderly are particularly susceptible to SO_2 exposure. Asthmatics who receive short-term exposure during moderate exertion may experience decreased lung function and symptoms such as whistling, chest tightness, or shortness of breath.[5]

[4] MESPI/KEPA-Raporti për gjendjen e ajrit 2021
[5] State of Illinois/ Illinois Environmental Protection Agency-Air quality report, 2020

Ozone (O_3)

Ozone is formed in the atmosphere through chemical reactions between pollutants emitted by vehicles, factories and other industrial sources, fossil fuels, combustion, consumer products, paint evaporation and many other sources. Hydrocarbons and nitrogen oxide gases react in the presence of sunlight to form ozone. Hot, sunny, calm weather promotes ozone formation. See fig.5.

Ozone has a very characteristic pungent smell, is sometimes described as chlorine bleach, and can sometimes be detected after lightning strikes or during electrical discharges.

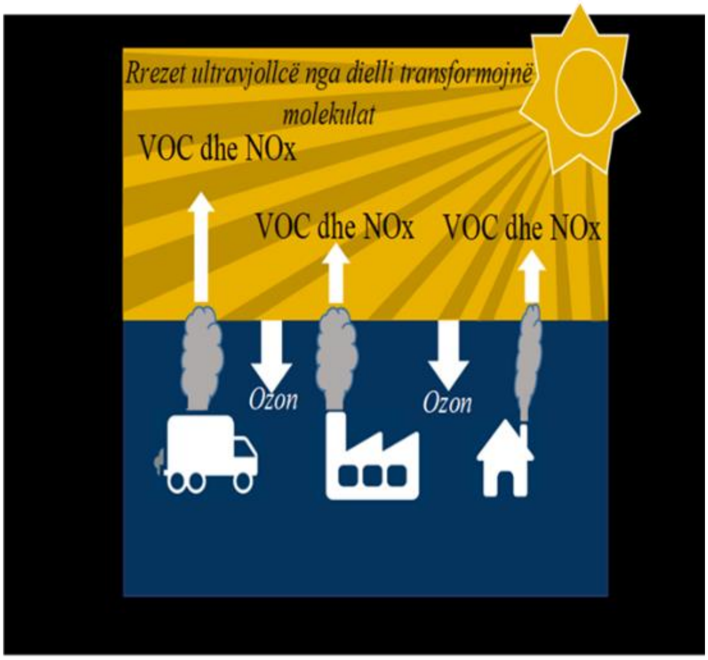


Fig.5. Ozone formation

Individual people vary in their ability to smell ozone; some people can smell it at levels of 0.05 ppm. Ozone can form naturally in the atmosphere from the electric discharge of the stratosphere from solar radiation e (troposphere), ozone is an air pollutant. O_3 is also a key component of urban smog.

The main sources of NOX and VOC are engine exhaust, emissions from industrial facilities, combustion from thermal power plants, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. O_3 at ground level can also be transported hundreds of miles under certain wind regimes. As a result, long-range transport of air pollutants affects the air quality of regions downwind of the current formation area.[6]

Other **effects** include increased hospital stays associated with difficulty breathing, chest pain, shortness of breath, throat irritation and cough. O_3 can reduce the immune system's ability to fight bacterial infections in the respiratory system. Long-term exposure to O_3 can cause permanent lung damage. O_3 also affects vegetation and forest ecosystems, including reduced yields of agricultural and forest crops, reduced resistance to pests and pathogens, and reduced survival of tree seedlings.

Persons at risk: Individuals more susceptible to the effects of O_3 exposure include those with a preexisting or chronic respiratory disease, children who are active outdoors, and adults who exercise or work actively outdoors.[7]

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[6] MESPI/KEPA, Report on the Sate of Air 2021
[7] State of Illinois/ Illinois Environmental Protection Agency-Air quality report, 2020

PM_{10} and $PM_{2.5}$

Suspended particles generally refer to particles with a diameter of less than 100 micrometers (human hair 60-100 micrometers in diameter (fig.6). Particles larger than 100 micrometers under the influence of gravity cannot stay in the air.

Sources: Combustion of fossil materials (ash and soot), industrial processes (metals, fibers, etc.), fugitive dust (wind and mechanical soil erosion) and photochemically produced particles (complex chain reactions between sunlight and gaseous pollutants).

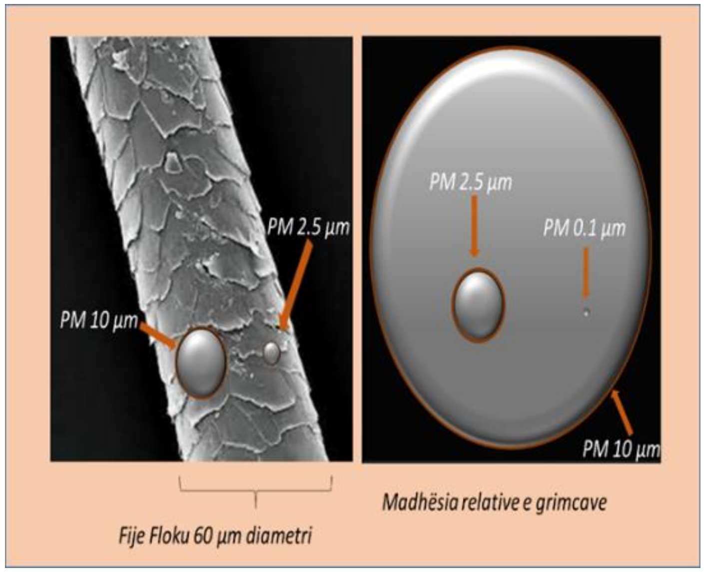

Fig.6. The diameter of a human hair and the ratio with PM_{10} and $PM_{2.5}$.

Combustion and photochemical products tend to be larger in size (less than 1 micrometer), while fugitive dust and industrial products are typically larger in size.

Effects: The effects of particles on health and well-being are directly related to their size and chemical composition. Particles enter the human body through the respiratory tract and their effects are immediate on this system, the size of the particles determines the depth of their penetration into the respiratory system.

Particles above 5 micrometers are usually deposited in the nose and throat. Those that penetrate deeper into the respiratory system in the air channels (bronchi).

Also, the effect on the plants is quite large because the particles are layered on the surfaces of the plants and it affects the growth rate of the plants.

Particulate air pollution also causes a wide range of damage to materials including corrosion of metals and electrical equipment and contamination of textiles and buildings.[8]

[8] State of Illinois/ Illinois Environmental Protection Agency-Air quality report, 2020

2. Air quality

2.1. Monitoring of air quality

Air quality monitoring is divided into two zones; the Agglomeration AKS1 and the Zone ZKS. In the Agglomeration AKS1, air quality monitoring is monitored by 5 monitoring stations, while in the Zone ZKS, air quality is monitored by 7 stations (Tab.1).

Table 1. Air quality monitoring stations, Agglomeration AKS1 and Zone ZKS1

Aglomeration	Name of the monitoring station	Station Sign (Code)	Location	Parameters to be measured	Station type	Date of functionalization
Aglomeration – AKS 1	HMIK	KS0101	Prishtinë	PM_{10}, $PM_{2.5}$, SO_2, NO_X, O_3, CO.	Urban background	09.01.2009
	Rilindja	KS0102	Yard of Rilindja Building	PM_{10}, $PM_{2.5}$, O_3, SO_2, CO, NO_2.	Urban background	06.05.2010
	Obiliq	KS0110	KCFM	PM_{10}, $PM_{2.5}$, SO_2, NO_X, O_3, CO.	Urban background	01.03.2013
	Dardhishtë	KS0111	L.S.S. "Abdurrahmon Gërguri"	PM_{10}, $PM_{2.5}$, O_3, SO_2, CO, NO_x.	Urban/industrial background	01.03.2013
	Palaj	KS0112	Facility Kosova Montim	PM_{10}, $PM_{2.5}$, SO_2, NO_X, O_3, CO.	Urban/industrial background	01.03.2013
ZONE – ZKS 1	Pejë	KS0305	L.S.S. "Lidhja e Prizrenit"	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO.	Urban background	04.04.2012
	Prizren	KS0406	L.S.S. "Abdyl Frashëri"	$PM_{2.5}$, PM_{10}, NOx, O3, SO_2, CO.	Urban background	01.04.2012
	Hani i Elezit	KS0508	L.S.S. "Ilaz Hallaqi"	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO.	Urban/industrial background	05.04.2012
	Gjilan	KS0609	L.S.S. "Selami Hallaqi"	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO.	Urban background	01.04.2012
	Drenas	KS0103	Address "Beqir Sinani" Str.	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO.	Urban background	05.04.2011
	Mitrovicë	KS0204	L.S.S. "Eqrem Qabej"	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO	Urban background	06.2013
	Brezovicë	KS0507	Ski Center	$PM_{2.5}$, PM_{10}, NOx, O_3, SO_2, CO.	Rural	

2.2. Online access system on air quality

The online monitoring system for air quality was created by MESPI and is monitored by the Hydrometeorological Institute of Kosovo in 12 stations at the country level (fig. 7, 8).
Access to the online system is done by clicking on the data system link on the website:

- http://ihmk-rks.net/?page=1,21, or also through the link:
- https://airqualitykosova.rks-gov.net/

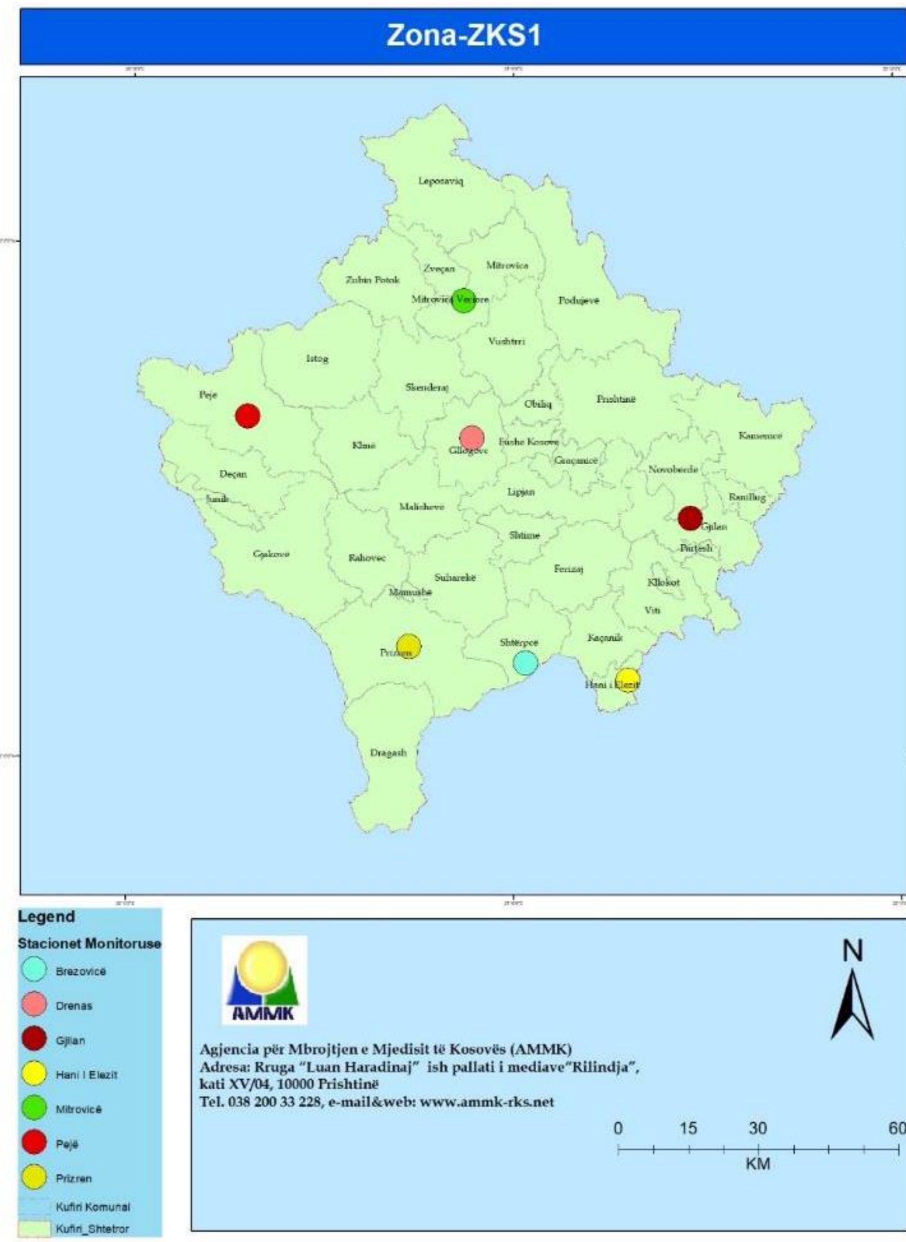

Fig.7. Locations of air quality monitoring stations

2.3 Agglomeration AKS1 (Prishtina Zone) – Air quality

In the Agglomeration AKS1 (Prishtina Zone), there are placed 5 monitoring stations:

- HMIK (Prishtina),
- Rilindje (Prishtina),
- Palaj (Obiliq),
- Dardhishtë (Obiliq).
- Obiliq center (Obiliq),

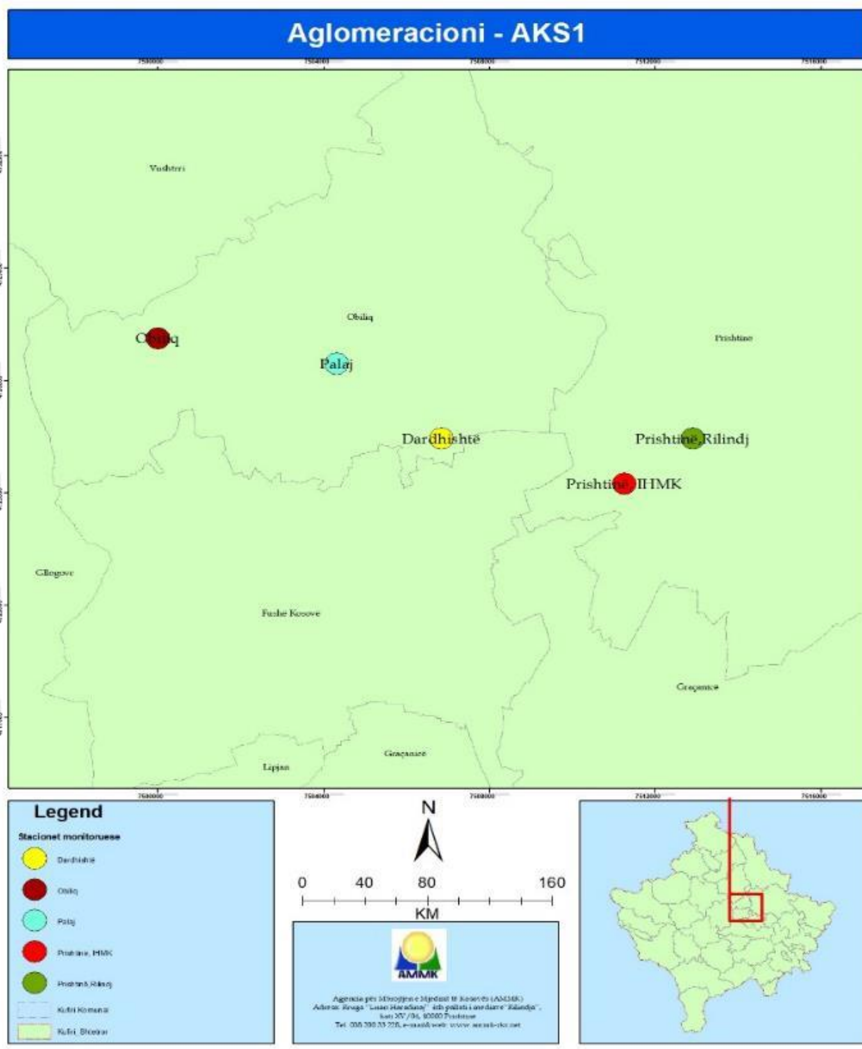

Fig.8. Locations of air quality monitoring stations Agglomeration-AKS1

PM_{10}

PM_{10} was monitored throughout the year 2022, at all monitoring stations located in the Agglomeration AKS1. From the data received, it is estimated that PM_{10}, there were recorded exceedances of the limit value according to the standard of 50 µg/m^3 on a daily basis at the monitoring stations. If the average monthly values for P_{10} are taken as a basis, a value of 51.4 µg/m^3 was recorded at the Rilindja monitoring station, which is higher than the average value (tab.2).

Table 2. Average monthly values of PM_{10} in Agglomeration AKS1

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	41.8	51.4	28.8	38.3	41.6
February	31.8	44.7	24	31.7	30.2
March	34.3	43.7	25.8	27.9	33.9
April	18.1	25.5	12.9	15.8	16
May	19	24.6	13.3	15.1	19.2
June	17.6	20.7	10.6	11.6	14.4
July	15.6	20.3	12.9	11.6	15.6
August	12.4	22.6	12.1	7.8	15
September	7.5	17.7	10.8	14.1	10.6
October	19.4	34.6	24.2	30.7	21.1
November	21	38.4	21.5	35.5	20.4
December	31	46	24	44	28
Avg. 2022	22.46	32.52	18.41	23.68	22.17

The average annual values for the PM_{10} pollutant were below the permissible values according to the annual standard of 40 µg/m^3 (fig. 9).

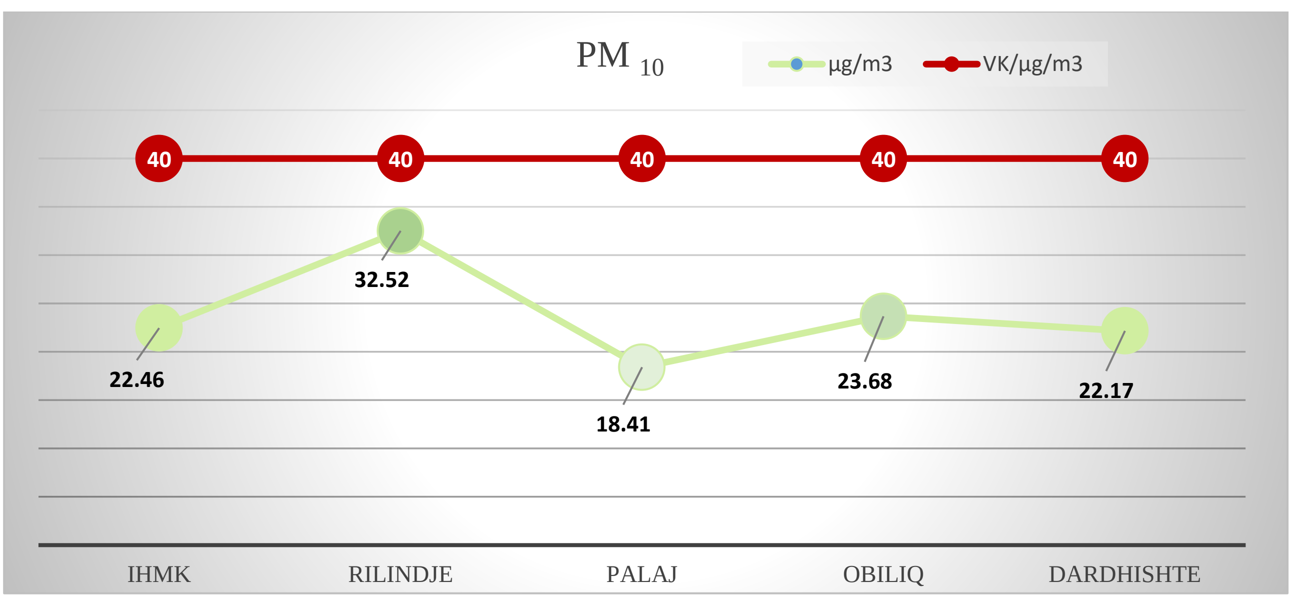

Fig. 9. Annual average values of PM_{10} in Agglomeration AKS1, 202

$PM_{2.5}$

The highest values of $PM_{2.5}$ were recorded at these monitoring stations:

- HMIK / Prishtina, (January, February and December, 2022),
- Rilindje/ Prishtina, (January, February, March, November and December, 2022),
- Obiliq, (January, November and December, 2022)
- Dardhishtë/Obiliq,(January, 2022) (Tab.3).

Table 3. Average monthly values of $PM_{2.5}$ in Agglomeration AKS1, 2022

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	34	39.9	23	33.2	35.5
February	24.4	30.9	17.1	24.5	24.6
March	23	28.2	15.6	19.8	22.5
April	11	13.8	7.5	10.5	9.5
May	10.5	12.1	7.1	8.1	9.2
June	10.8	11.6	6.9	7.3	7.7
July	8.9	10.4	6.6	6.7	7.4
August	7.9	12.6	7.4	6.4	8.2
September	5.6	10.5	6.6	10	7
October	13.4	21.5	13.4	21.9	13.9
November	15.8	26.7	14.3	27.1	16
December	25.3	35.9	19.1	37.2	23.8
Avg. 2022	15.88	21.18	12.05	17.73	15.44

The annual average values for the $PM_{2.5}$ parameter were below the permissible values according to the standard, which is 25 $\mu g/m^3$, (fig.10).

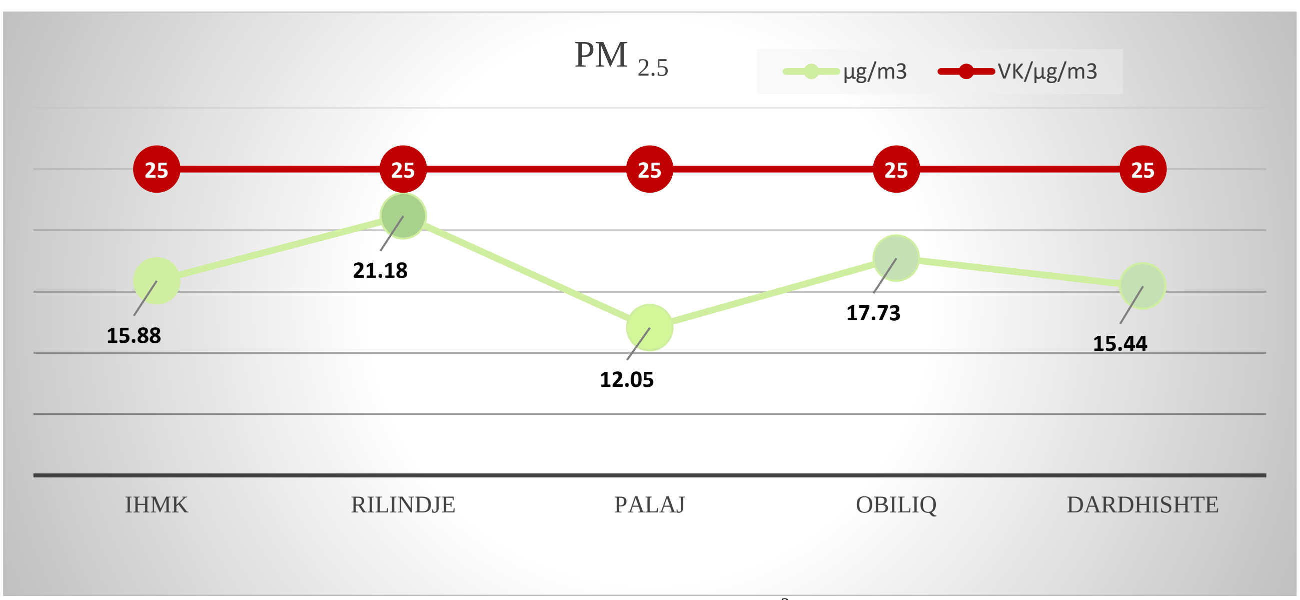

Fig. 10. Annual limit values of $PM_{2.5}$ $\mu g/m^3$ in AKS1 for the year 2022

Ozone (O_3)

There were not recorded any exceedances of the average monthly values for O_3 during the year 2022. The highest values were assessed at the Rilindja and Palaj monitoring stations. The highest value in the monthly average was recorded at Rilindje station, during the months of July with 73.3 µg/m^3 (tab.4).

Table 4. Average monthly values of O_3 in Agglomeration AKS1, 2022

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	18.8	29.4	35.8	13.8	19.9
February	28.4	38.2	38	19.3	19
March	41.9	56.9	46.6	25.5	21.1
April	63.9	61.1	48.3	28.9	18.2
May	53.3	60.3	49.5	14.6	14.3
June	47.6	60.5	65.5	13.5	61.3
July	57.5	73.3	71	20.4	70.3
August	54.8	65.3	67.1	19	69.5
September	25.9	40.7	44.5	6.4	43
October	15.5	26.2	40.3	4.7	25.7
November	14.8	23.4	37.6	8.5	15.8
December	12	17	32	8	7
Avg. 2022	36.2	46.03	48.02	15.22	32.09

The average annual values for the parameter O_3 were below the permissible values according to the standard, which is 120 µg/m^3 (fig. 11).

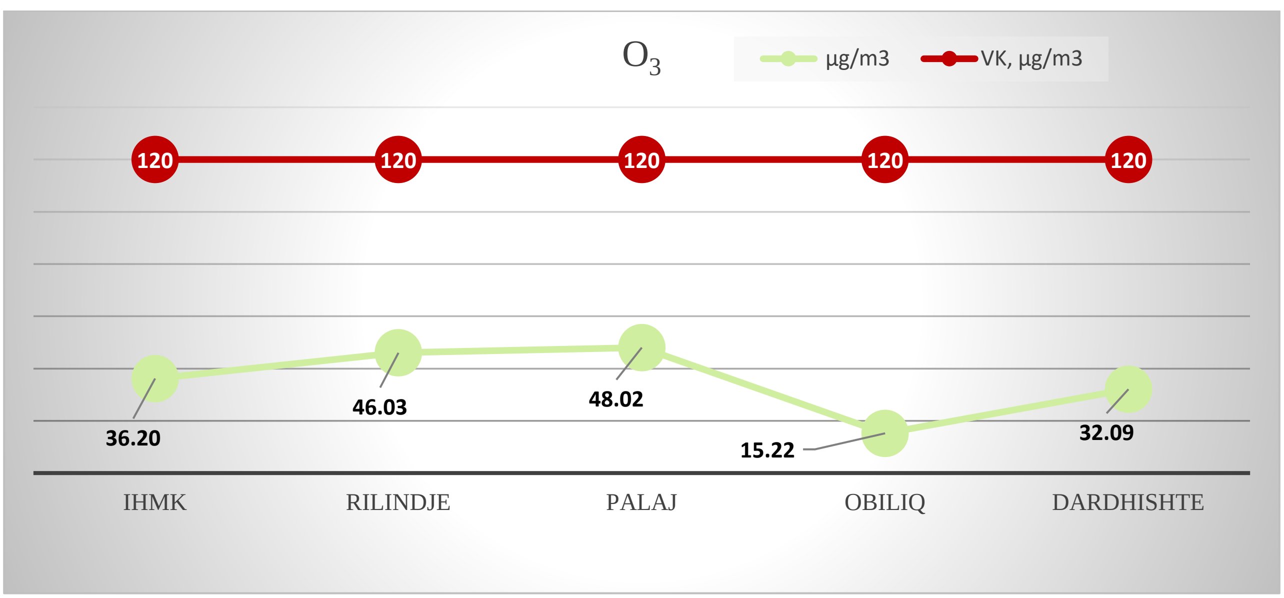

Fig. 11. Annual limit values of O_3 µg/m^3 in AKS1 for the year 2022

Sulfur dioxide (SO_2)

SO_2 in air quality resulted without exceedances to the limit values during the year 2022 in the Agglomeration AKS1. In Table 5 there are presented monthly and annual average values for SO_2. In all monitoring stations for the whole year, the limit values were within the permissible values (tab. 5).

Table 5. Average monthly values of SO_2 in Agglomeration AKS1, 2022

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	1.9	13.9	4.7	11.2	8
February	1.5	12.1	3.1	11.4	3.7
March	7.2	14.8	5.1	11.2	10.1
April	9.5	14.1	2.9	15.6	5.7
May	8.2	8.9	6.2	6.3	11.6
June	10	8.3	4.9	9.2	11.5
July	12.1	10.3	9.4	4.7	10.9
August	16.9	7.4	21.9	6.3	8
September	19	6.4	23	4.8	6.8
October	20.5	8.3	24.4	6.9	7.5
November	10	6	24	11	10
December	9	8	6	14	12
Avg. 2022	10.48	9.88	11.3	9.38	8.82

The annual average values for the SO_2 parameter were below the permissible values according to the standard, which is 125 µg/m^3. The highest value was recorded at the HMIK station with 20.5 µg/m^3 (fig. 12).

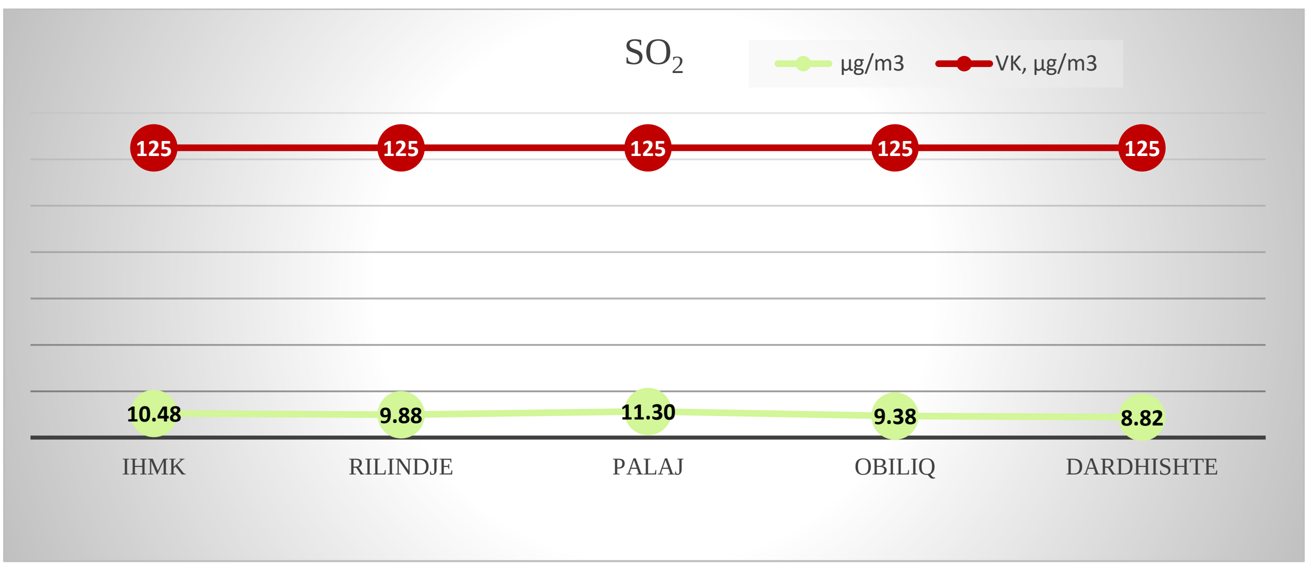

Fig. 12. Limit values of SO_2 µg/m3 in AKS1 for the year 2022

Nitrogen Dioxide (NO_2)

The level of the presence of NO_2 in the air quality did not record any exceedance of the permissible value. In table 6 there are presented the average monthly and annual values for the parameter NO_2, and it has been estimated that there were no exceedances of the limit values during the year 2022. The highest values were recorded at the Rilindja air quality monitoring station.

Table 6. Average monthly values of NO_2 in Agglomeration AKS1, 2022

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	35.9	30.5	14.3	24.6	21.5
February	33.3	25.7	12.4	22.1	20
March	36.3	21.5	10	25.7	24.8
April	22.8	15.8	8.1	20.5	4.6
May	27	14.4	8.2	18.8	10.5
June	24.9	12.9	7	9.8	8.1
July	26.9	15.3	8	14.4	5
August	29.3	15.4	7.5	10.5	3
September	19.6	12.5	7	7.6	6
October	29.2	14	9.8	10.7	11.6
November	21.7	12	11.1	12.7	6.1
December	16	12	14	15	14
Avg. 2022	26.91	16.83	9.78	16.03	11.27

The annual average values for the parameter NO_2 were below the values allowed according to the standard, which is 40 µg/m^3. The highest value was recorded at the HMIK station: 36.3 µg/m^3 (fig. 13)

Fig. 13. Annual limit values of NO_2 µg/m^3 in AKS1 for the year 2022

Carbon monoxide (CO)

CO has been estimated without exceedances of the limit values during the year 2022 (tab. 9). This parameter was recorded with the highest value at the HMIK station at 2.6 mg/m^3. January, February and March of 2022 were assessed as the highest values on a monthly basis (tab. 7).

Table 7. Average monthly values of CO in Agglomeration AKS1, 2022

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishte
January	2.4	2.5	0.1	1.9	1.2
February	2.6	0.8	0.1	1.6	1.2
March	2	0.7	0.1	0.8	1.5
April	1.5	0.4	0.1	0.8	1.3
May	1.2	0.4	0.1	0.1	1.2
June	1.1	0.6	0.1	0.8	1.3
July	1	1.3	0.1	0.4	1.9
August	1	1	0.04	0.4	1.9
September	0.9	0.5	0.04	0.3	0.5
October	1.2	0.9	0.05	0.7	1
November	1.4	0.7	0.1	1	1.2
December	1.4	0.2	0.1	1.2	1.4
Avg. 2022	1.48	0.83	0.09	0.83	1.3

Annual CO values are within the limit values of 10 mg/m^3, in all monitoring stations (fig.14).

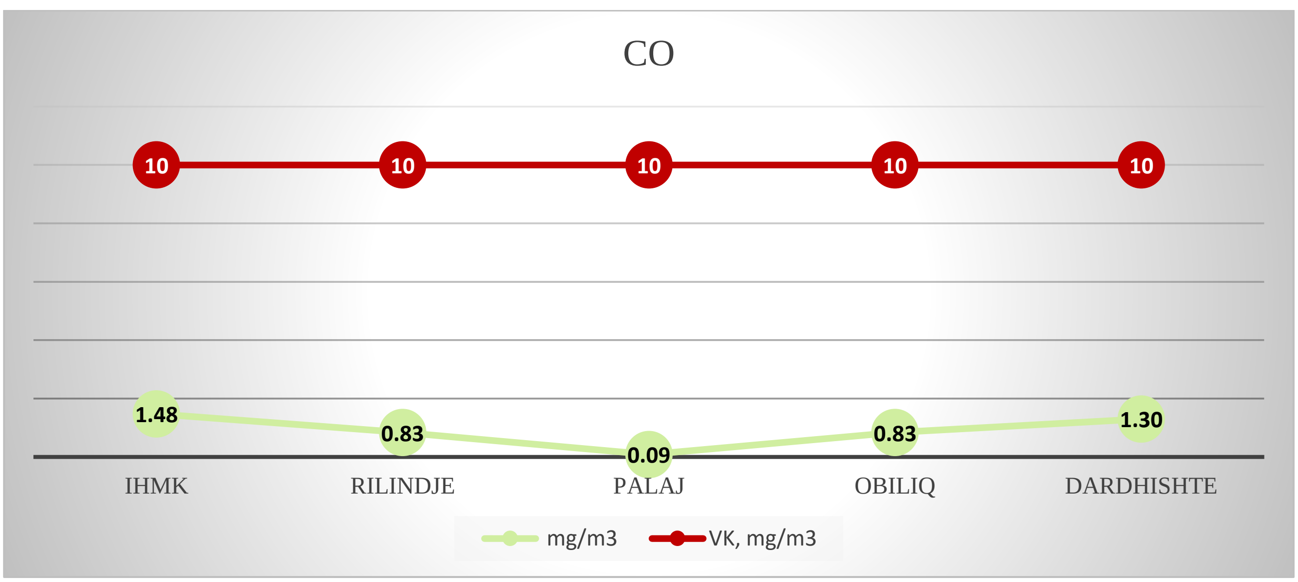

Fig. 14. Annual average permissible values of CO mg/m^3 in AKS1 for the year 2022

Days with exceedances for PM_{10}

In the Agglomeration Zone AKS1, there were recorded 152 days with exceedances of the permissible values for PM_{10} in 2022. The highest number of days with exceedances of the values for PM_{10} were recorded at the stations Rilindja (59 days) and Obiliq (40 days). In these two stations, there were recorded days with exceedances of the permissible values , which is up to 35 days in a year (tab. 8).

Table 8. Days with exceedances for the Agglomeration Zone AKS1

Month	HMIK	Rilindje	Palaj	Obiliq	Dardhishtë	Gjithsejtë
January	10	15	2	10	11	48
February	5	9	1	4	2	21
March	4	8	1	3	4	20
April	0	0	0	0	0	0
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	0	4	0	4	0	8
November	0	10	1	8	1	20
December	6	13	1	11	4	35
2022	25	59	6	40	22	152

Compared to the year 2021, in 2022 at the level of the AKS1 Zone, there were recorded 12 more days with exceeding the permissible values of PM_{10} (fig. 15).

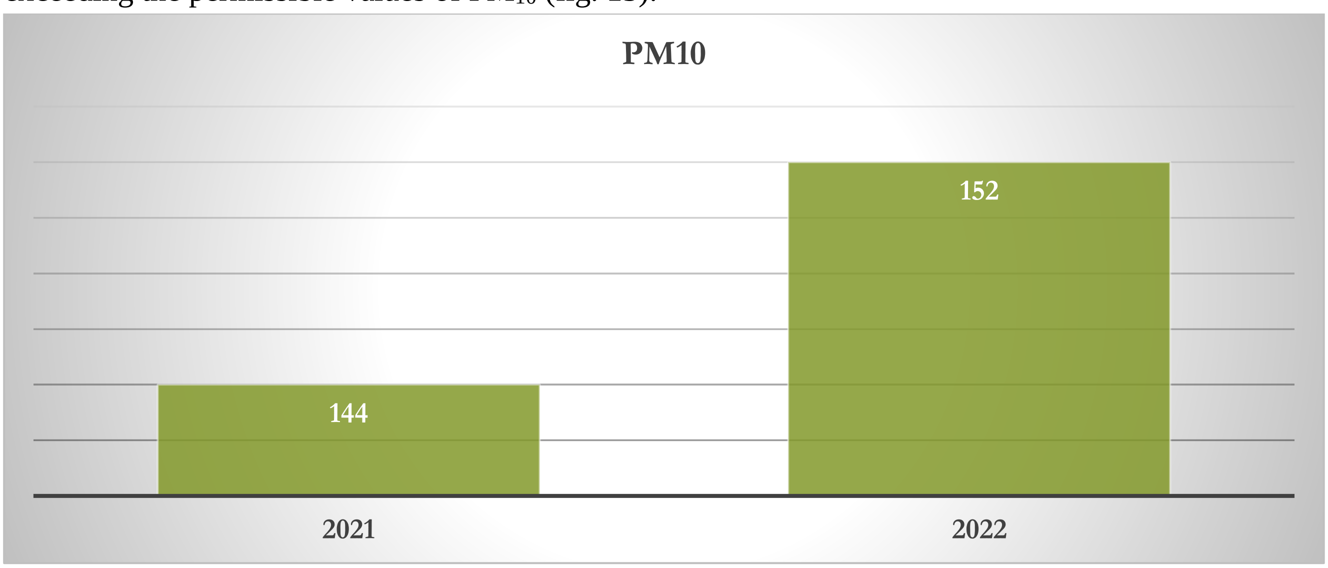

Fig. 15. Number of days with exceedances for the Agglomeration AKS1 2021-2022

2.4. ZONE ZKS1- Air quality

Photo 1. Kosovo Plain (T.Veselaj, 2022)

PM_{10}

Average monthly values for the parameter PM_{10} have been found to be the highest in the monitoring station of Gjilan, Peja and Mitrovica. The highest average values were estimated to be at the Gjilan station at 69.10 µg/m^3, during the months of January 2022. And based on these data, it is estimated that there were exceedances of the daily limit value of 50 µg/m3 at the Gjilan monitoring station in the month of January (tab. 9).

Table 9. Average monthly values of PM_{10} in ZKS1, 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani Elezit	Gjilan
January	29.8	31.8	38.9	34.3	3.8	29.1	69.1
February	21.1	30.6	32.4	21.9	4.6	25	47.4
March	22	31.6	26.2	25.7	18.2	28	40.9
April	10.8	21	15.5	14.8	10.2	18.2	18.7
May	13.6	18.8	14.7	14.4	12	17	16.7
June	13.2	16.8	13.5	12.6	14.9	13.6	14.5
July	13.9	15.5	11.5	11.5	21	12.3	15.3
August	13.3	15.6	13.4	12.3	17	12.2	16.2
September	9.3	14.8	11.4	9.8	6.1	10.8	12.8
October	23.8	32.8	23	19.7	7.9	16.2	27.9
November	24.1	34.2	39.2	24.3	5.4	23	37.5
December	27	42	43	32	5	30	46
Avg. 2022	18.49	25.46	23.56	19.44	10.51	19.62	30.25

The average annual values of PM_{10} were below the permissible values according to the standard, which is 40 µg/m^3 (fig.16).

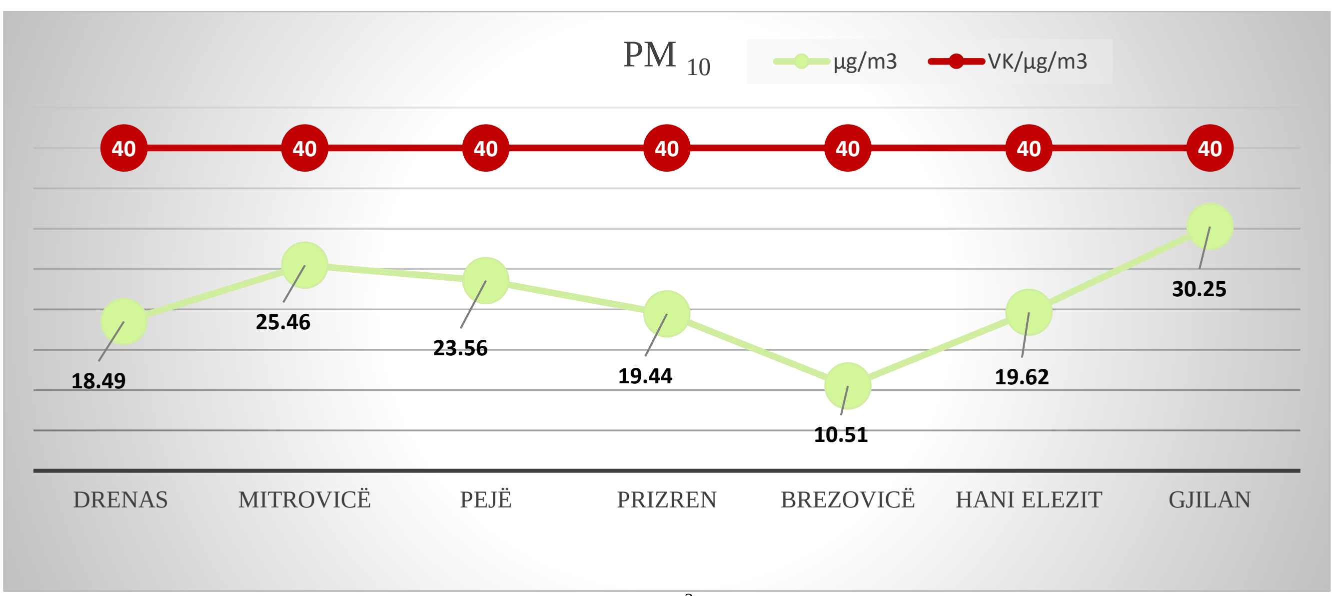

Fig. 16. Annual limit values of PM10 µg/m^3 in AKS1 for the year 2022

$PM_{2.5}$

From the data assessments for $PM_{2.5}$, there was established that that there have been exceedances of the limit values in the monthly average in these air quality monitoring stations: Drenas, Mitrovica, Peja, Prizren, Hani i Elezit and Gjilan. High values are estimated to be during the months of January and December at all monitoring stations except for Brezovica. The highest average monthly values were assessed at the monitoring station of Gjilan, in which the average monthly value reaches up to 60.4 µg/m^3 (tab. 10).

Table 10. Average monthly values of $PM_{2.5}$ in ZKS1, 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani Elezit	Gjilan
January	27.7	27	33	28.5	2.8	25.1	60.4
February	19.1	24.7	25	18.1	4.1	20	40.8
March	18.1	23.3	20.3	18.8	11.9	21.2	31.3
April	8.1	13.1	10.7	9	6.2	10.4	13.2
May	8.4	10.8	8.2	8	8.8	9.1	10.5
June	8.2	10.6	7.9	7.5	11.8	8.2	9.6
July	7.9	9.1	6.6	6.8	12.4	7.5	9.3
August	8.9	9.9	7.7	7	12.3	8.1	10.8
September	6.8	9.8	7.4	6	5	6.8	9.1
October	17.1	21.9	14.9	13.6	5.5	12	21.6
November	19.6	25.8	28.9	18.9	3.8	18.8	32.1
December	25.4	35.8	36.4	27.2	3.2	26.3	41.3
Avg. 2022	14.61	18.48	17.25	14.12	7.32	14.46	24.17

The average annual values for the parameter $PM_{2.5}$ were below the permissible limits according to the standard, which is 25 µg/m^3, whereas the highest annual values were recorded at the Gjilan station with 24.17 µg/m^3 (fig. 17).

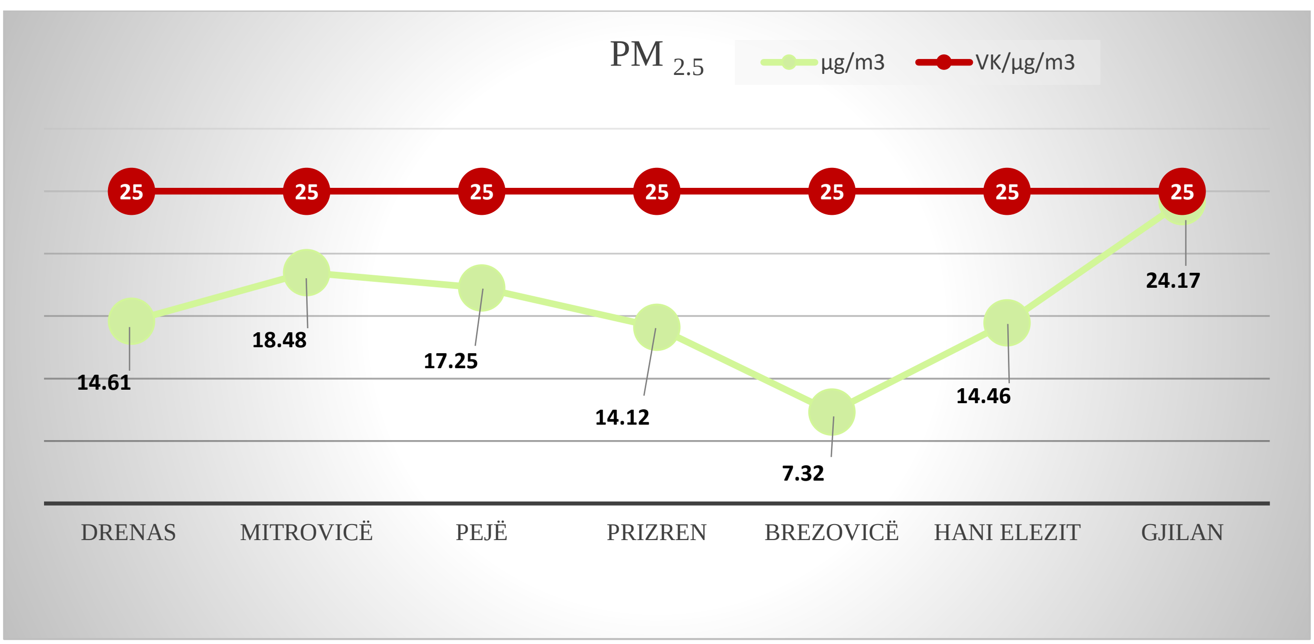

Fig. 17. Annual limit values of $PM_{2.5}$ µg/m^3 in AKS1 for the year 2022

Ozone (O_3)

The Ozone parameter (O_3) based on the assessment, the average monthly values show that in all monitoring stations there were no exceedances of the limit values during the year 2022. The highest average monthly values were recorded at the monitoring station in Brezovica with 98.7 µg/ m^3. The increase in ozone values was recorded during the Spring-Summer period of 2022. The air quality monitoring station in Brezovica is as the reference station (tab. 11).

Table 11. Average monthly values of O_3 in ZKS1, 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani Elezit	Gjilan
January	42.5	31.6	41.8	41.7	66.8	47.5	31.3
February	52.5	33.5	51.3	54.6	77.4	52.9	41.6
March	53.5	47.7	76.6	71.5	85.8	70.7	57.5
April	69.3	43.4	76.2	72.3	86.5	68.9	64.2
May	65.6	30.3	73.4	72.6	87.3	69.1	64.5
June	70	28.3	72.1	77.4	90.8	76.6	67.8
July	79.4	44.6	91.2	93.6	98.5	91.2	78.5
August	37.7	34.9	79.5	84.5	98.7	85	73.3
September	52.9	16.1	51.7	54.8	80	49.5	53
October	32.1	13.2	42.4	38.8	72.9	46.4	37.8
November	32.6	14.5	25.4	27.1	67.1	30.6	29.1
December	25	10	17	21	29	22	25
Avg. 2022	51.1	29.01	58.22	59.16	78.4	59.2	51.97

The average annual values for O_3 were below the permissible values of 120 µg/m^3. The highest value was recorded at the Brezovica monitoring station with 78.40 µg/m^3 (fig.18).

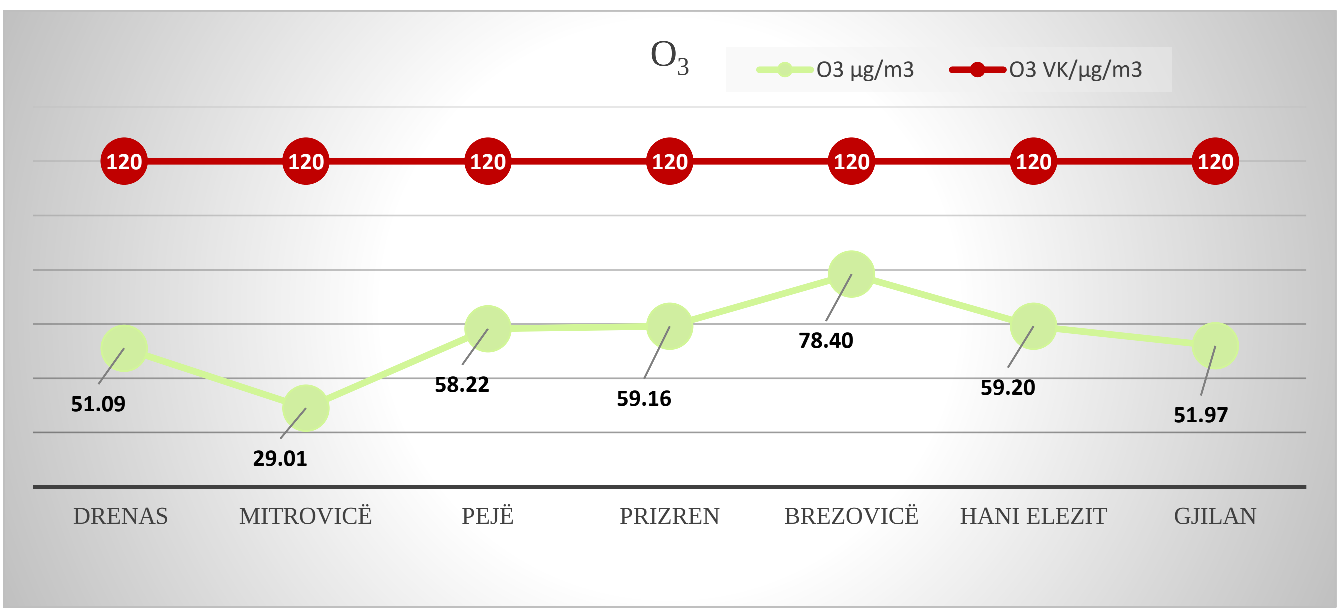

Fig. 18. Annual limit values of O_3 µg/m^3 in AKS1 for the year 2022

Sulfur Dioxide (SO_2)

At the air quality monitoring station in Mitrovica, there are presented the highest average monthly values compared to the values of other stations of ZKS1 Zone. Despite the fact that these values were recorded as the highest in Mitrovica, it is estimated that this parameter did not have any exceedances to the limit values during the year 2022 (table 12).

Table 12. Average monthly values of SO_2 in ZKS1, 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani Elezit	Gjilan
January	11.6	13.2	8.4	9.2	4.8	4.1	3.4
February	10.5	13.6	8.3	8.3	4.9	3.3	2.7
March	22.1	14.6	8.4	10.4	6.5	4.1	2.6
April	10	21.3	7.7	7.5	5.2	3.3	1.9
May	9.7	29.8	7.8	7.4	5.8	2.7	4.2
June	10.6	19.8	8.5	8.4	3.1	8.4	1.8
July	12	20.4	9.7	9	5.3	3.1	1.3
August	3.2	14	11	10.9	6	3.4	2.2
September	2.3	15.6	12.9	16.6	6.6	5.5	3.4
October	4.2	28.5	16.2	16.2	6.5	10	6.1
November	5	31	4	6	6	9	8
December	5.1	25	9	5	5.5	8	7
Avg. 2022	8.86	20.57	9.33	9.58	5.52	5.41	3.72

The annual average values for SO_2 were below the permissible values of 125 µg/m^3. The highest value was recorded at the Mitrovica station, with 20.57 µg/m^3 (fig.19).

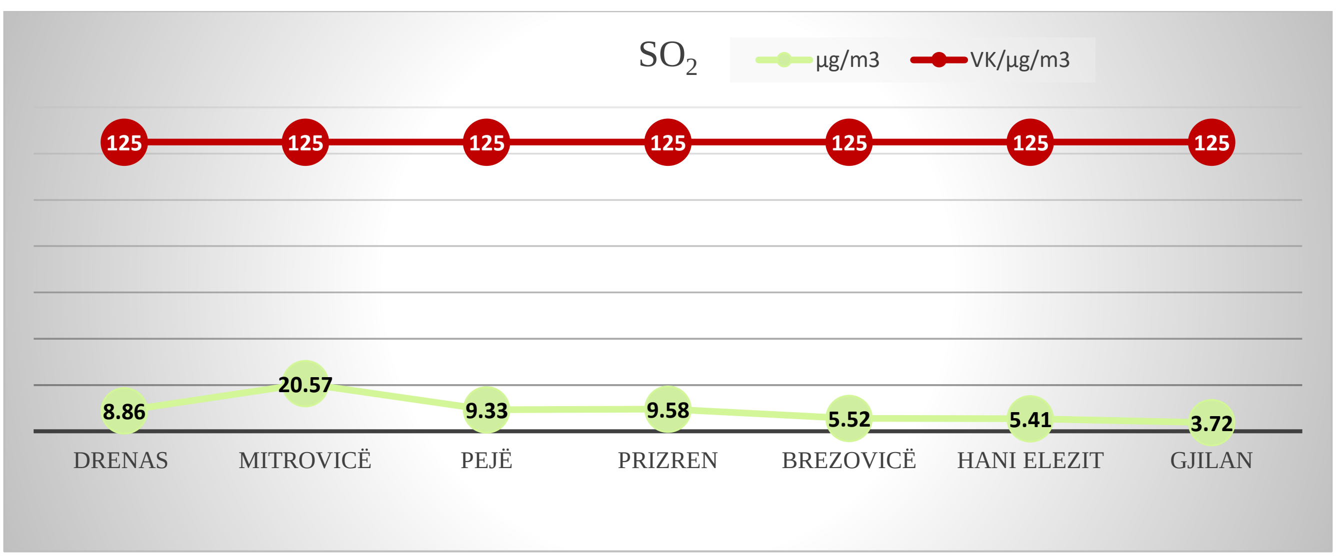

Fig. 19. Annual limit values of SO_2 µg/m^3 në AKS1 për vitin 2022

Nitrogen Dioxide (NO_2)

Nitrogen dioxide has been assessed with a higher value in the monthly average at the Gjilan monitoring station. The highest values were recorded in the month of January, 2022, at 36.6 µg/m^3 (tab. 13).

Table 13. Average monthly values of NO_2 in ZKS1, 2022

Month	**Drenas**	**Mitrovicë**	**Pejë**	**Prizren**	**Brezovicë**	**Hani Elezit**	**Gjilan**
January	20.9	15.4	24.9	24.7	11.2	17.1	36.6
February	16.3	16.1	22.8	21	10.6	17	32.4
March	17.1	12.7	16.5	18.6	22.1	17	25.1
April	9.4	11	11.1	14.9	13.6	14.7	17.1
May	9.2	10.9	8.5	11.8	0.9	14.5	15.1
June	8.4	11.9	8	10.3	1.4	9.8	11.7
July	11.6	10.1	8.2	10.2	1.9	11.1	16.2
August	21.1	8.5	10.2	13.1	1.9	11.3	17.1
September	8.6	6.8	10.7	12.9	1.3	16.2	13.9
October	16.1	11.3	17.1	19.4	1.2	17.5	22.1
November	14.9	14.1	24.7	24	1.1	18.6	22.2
December	16	11	23	24	1	20	25
Avg. 2022	14.13	11.65	15.48	17.08	5.68	15.4	21.21

The average annual values for NO_2 have been below the permissible values of 40 µg/m^3. The highest value was recorded at the Gjilan station with 22.53 µg/m^3 and in Prizren with 19.08 µg/m^3, compared to other stations (fig. 20).

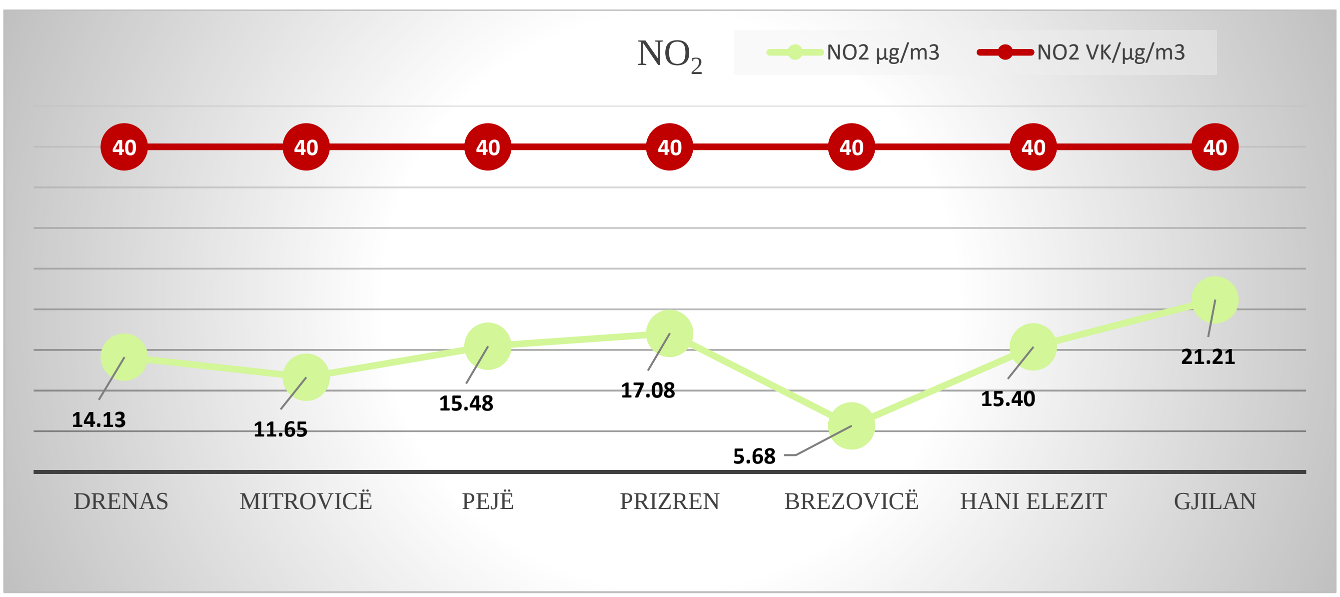

Fig. 20. Annual limit values of NO_2 µg/m^3 in AKS1 for the year 2022

Carbon monoxide (CO)

According to the data assessments for the year 2022, it is established that this parameter did not exceed the limit values. The highest monthly average value is assessed to be during the month of January 2022 at the Gjilan station (tab. 14).

Table 14. Average monthly values of CO in ZKS1, 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani Elezit	Gjilan
January	1.3	0.4	1.2	1	0.9	0.5	2.1
February	1	0.3	1.2	0.7	0.4	0.3	1.4
March	0.6	0.3	1.1	0.6	0.5	0.2	0.9
April	0.7	0.2	0.2	0.6	0.7	0.1	0.5
May	0.2	1	0.1	0.5	0.7	0.2	0.3
June	0.3	0.1	0.2	0.4	0.3	0.3	0.2
July	0.4	0.2	0.2	0.2	0.7	0.1	0.1
August	0.4	0.2	0.3	0.3	0.7	1	0.1
September	0.5	0.3	0.3	0.4	0.6	0.1	0.1
October	0.8	0.4	0.5	0.6	1.3	0.2	0.3
November	0.5	0.6	1.1	0.9	0.3	0.3	0.7
December	0.8	0.9	1.1	1.3	0.8	0.7	1.1
Avg. 2022	0.63	0.41	0.63	0.63	0.66	0.33	0.65

The annual average values for the CO parameter were below the permissible values, which is 10 mg/m^3. The highest value was recorded at the Gjilan station, with 0.65 mg/m^3 (fig. 21).

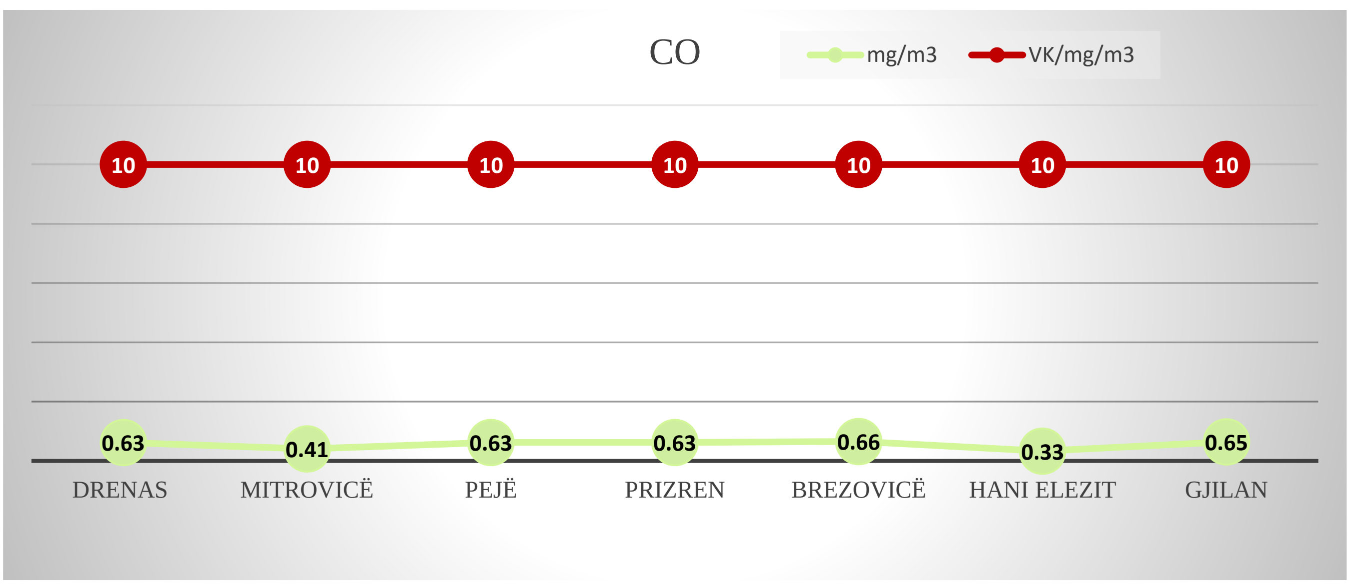

Fig. 21. Annual limit values of CO mg/m^3 in AKS1 for the year 2022

Days with exceedances for PM_{10} during 2022

In ZKS1 Zone there were recorded a total of 147 days with exceedances. The highest number of days with PM_{10} parameters was recorded at the Gjilan station, a number that exceeds the standard of 35 days within a year. The number of days with exceedances at this station is 52 days (tab. 15).

Table 15. Number of days with exceedances for PM_{10} during 2022

Month	Drenas	Mitrovicë	Pejë	Prizren	Brezovicë	Hani i Elezit	Gjilan	Total
January	4	4	9	6	0	3	19	45
February	1	5	4	2	0	0	12	24
March	0	2	0	1	1	0	7	11
April	0	0	0	0	1	0	0	1
May	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0
October	0	4	0	0	0	0	0	4
November	0	6	4	10	0	0	5	25
December	2	9	10	3	0	4	9	37
2022	7	30	27	22	2	7	52	147

If it is taken as a comparison with the year 2021, the year 2022 had fewer days with exceedances (fig. 22).

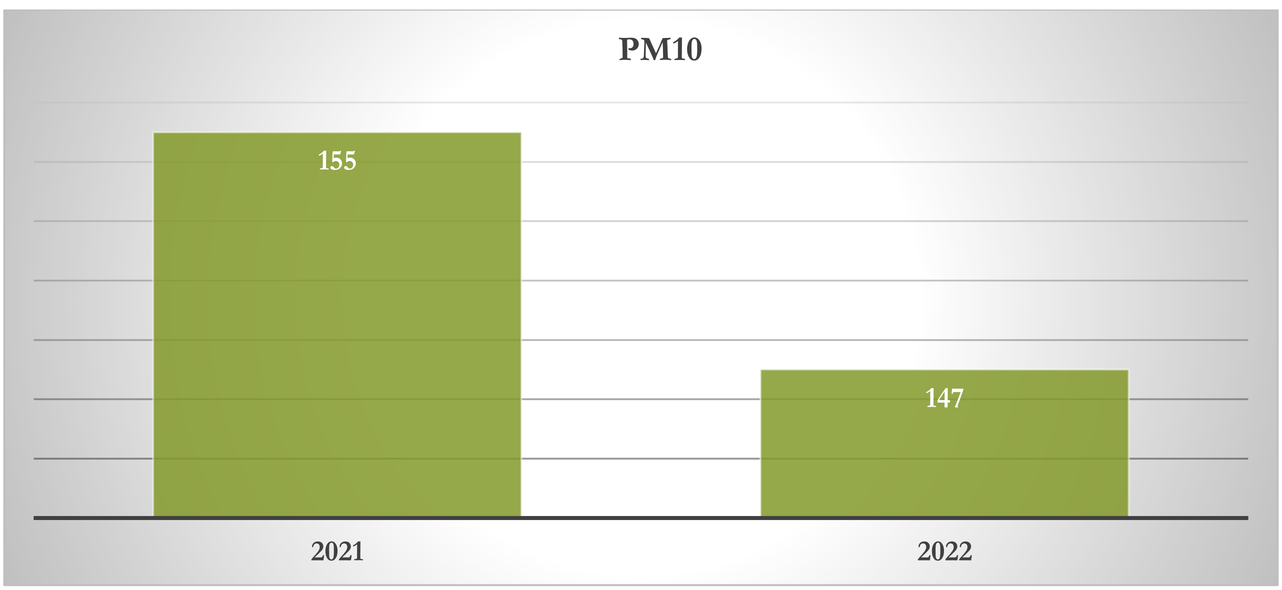

Fig. 22. Number of days with exceedances for the Zone KS1 2021-2022

2.5. Air quality trend 2013-2022

The air quality trend for PM_{10} during 2013-2022 shows that there are improvements in the direction of reducing this pollutant in the air. The year 2022 is the best year compared to previous years and with a very good coverage of the air quality monitoring network (fig.23).

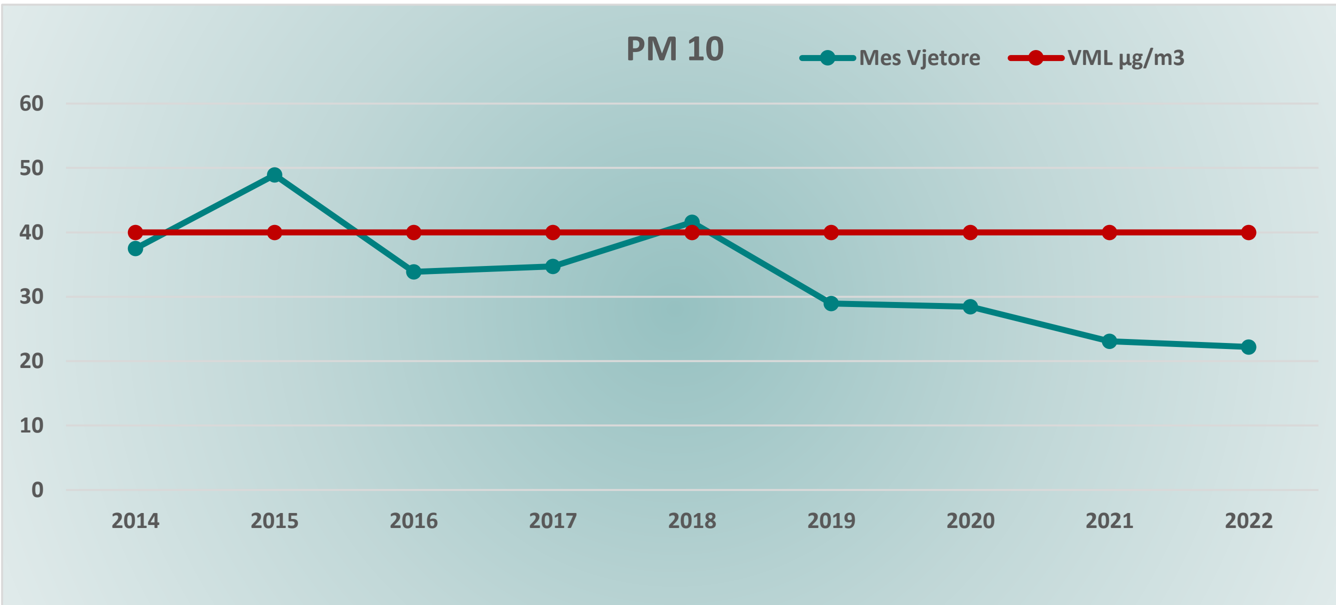

Fig. 23. Air quality trend for PM_{10} for the years 2013-2022

The air quality trend for the parameter $PM_{2.5}$ has improved since 2019. In 2022, there is a significant trend of decreasing concentration of this parameter and the air quality is better compared to the previous years (fig. 24).

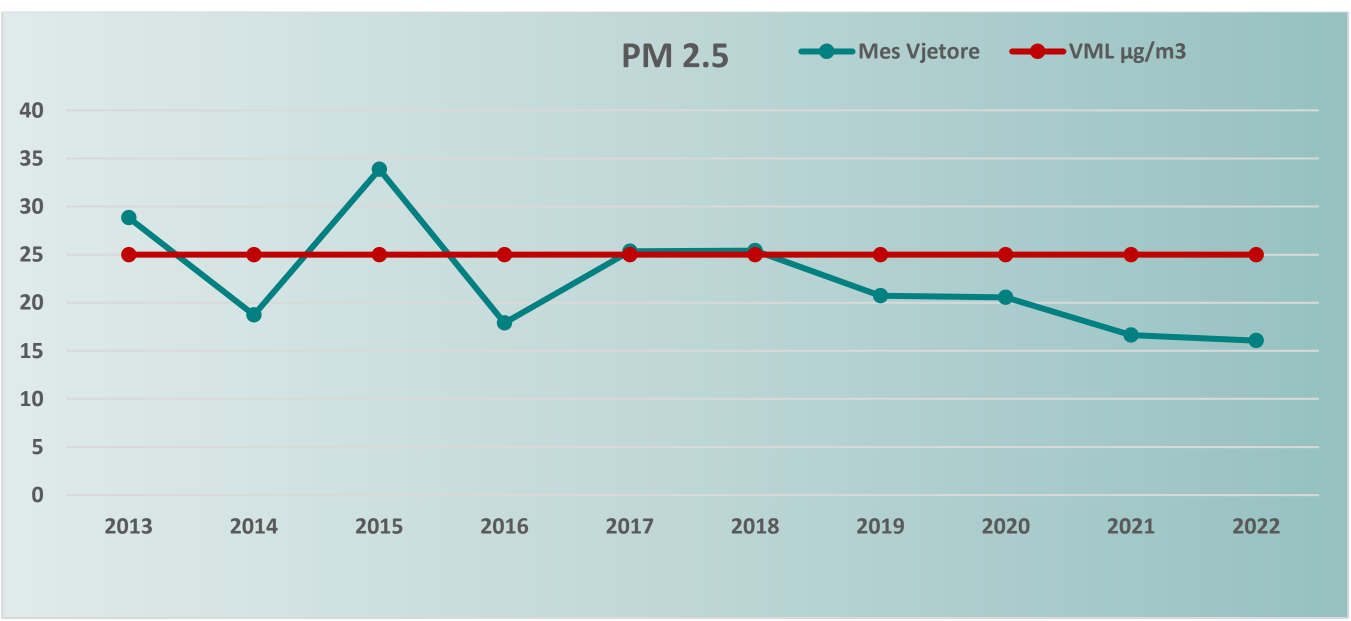

Fig. 24. Air quality trend for $PM_{2.5}$ for the years 2013-2022

The ozone concentration trend from 2018-2022 shows little concentration mobility. As a comparison from 2021, in 2022 there is observed a significant decrease in concentration, whereas 2017 is the year with the lowest annual average (fig.25).

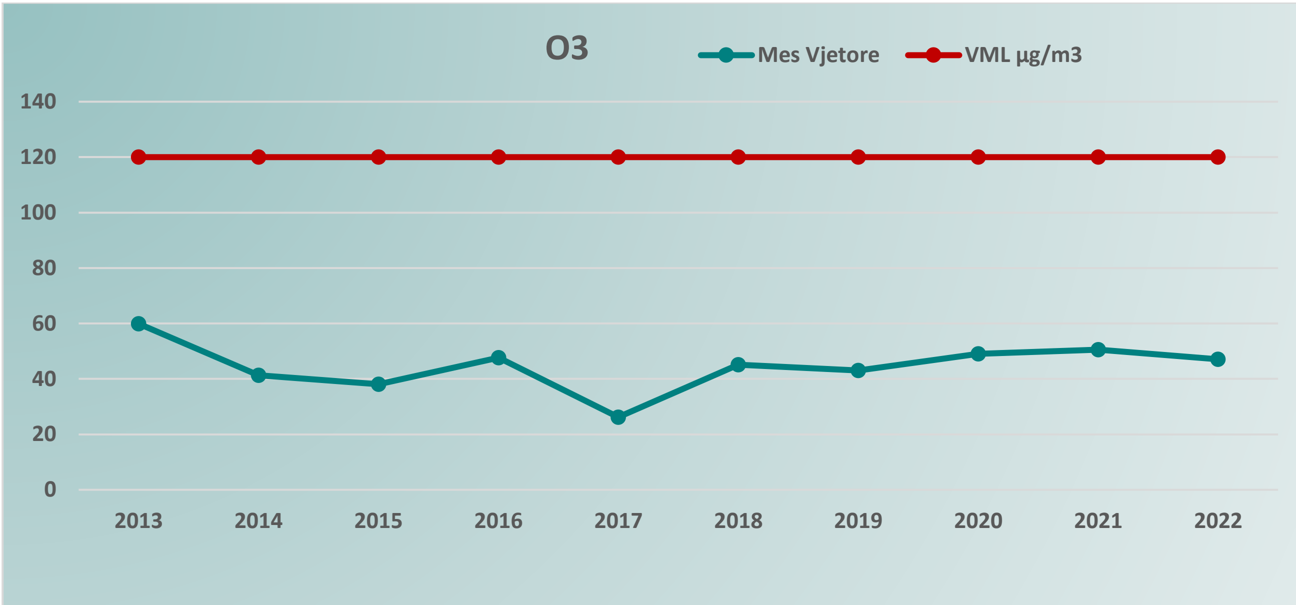

Fig. 25. Air quality trend for O_3 for the years 2013-2022

The SO_2 concentration trend from 2019-2022 indicates an improvement in the situation. During the year 2022, the SO_2 parameter had lower levels of concentration compared to the year 2021 (fig.26).

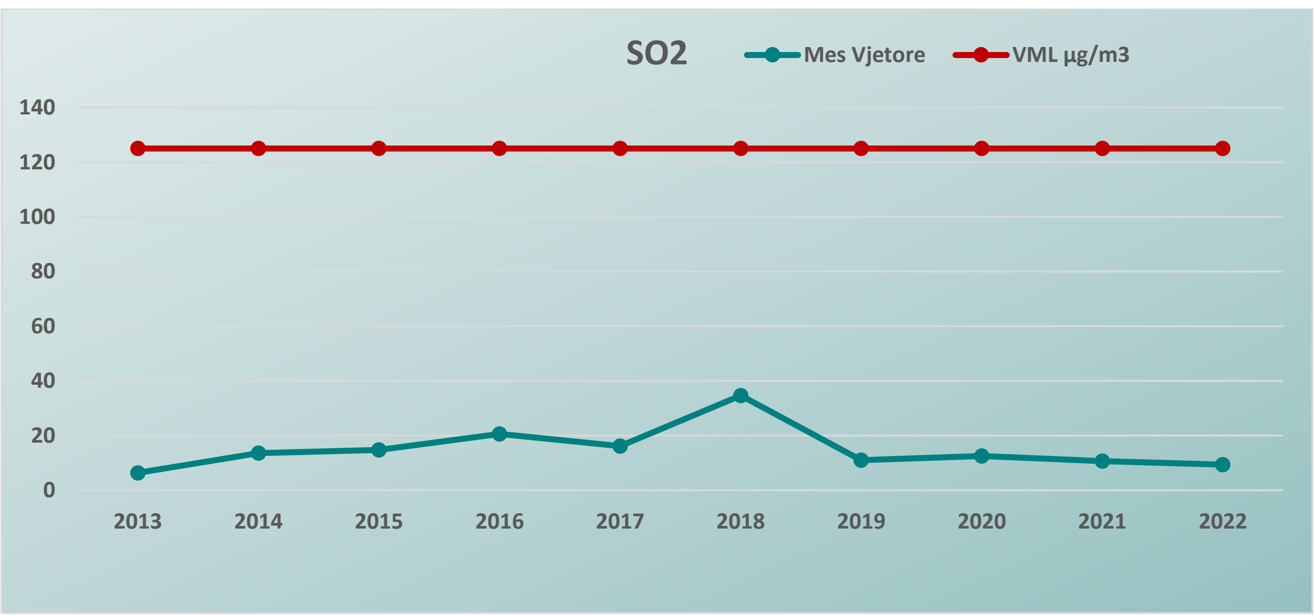

Fig. 26. Air quality trend for SO_2 for the years 2013-2022

The NO_2 concentration trend shows that during the years 2016-2019 there was a higher concentration of this pollutant in the air. Since 2019-2021 there was a decrease in the concentration of this pollutant parameter, while for 2022 there was an increase in concentration compared to 2021. Throughout all these years, the annual concentration values of this pollutant have been lower than the standard permissible rates (fig.27).

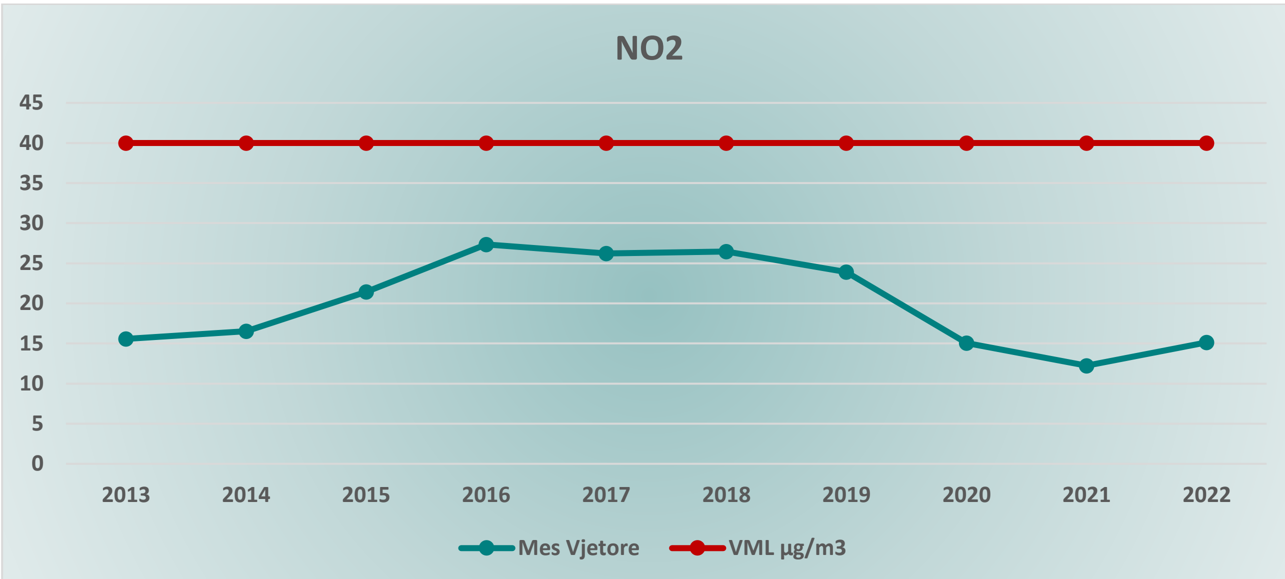

Fig. 27. Air quality trend for NO_2 for the years 2013-2022

The trend of CO concentration in the air from 2019-2022 shows that there have been continuously decreasing values from year to year (fig. 28).

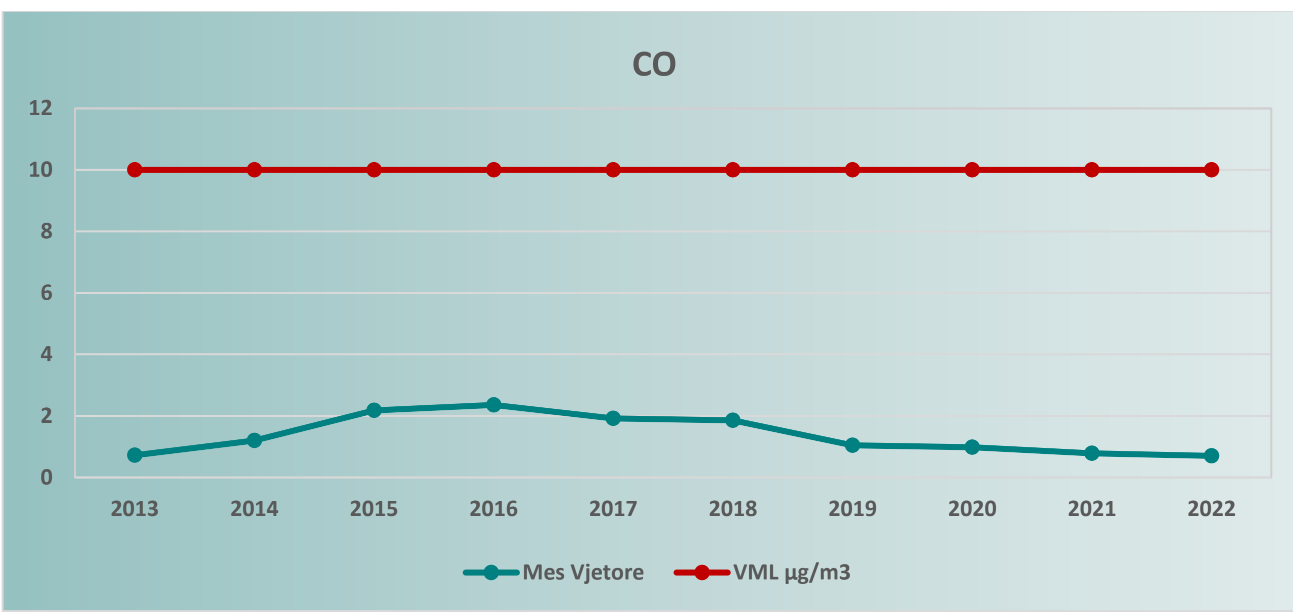

Fig.28. Air quality trend for CO for the years 2013-2022

3. Assessment of pollutant emissions by operators for the year 2022

Operators holding Integrated Environmental Permits are required to report to MESPI/KEPA for the release of pollutant emissions into the air.

Based on the Directive 2001/80/EC, as well as the national legislation AI/No. 07/2021 on the rules and standards for emission from stationary pollution sources, the permissible values for environmental emission standards are outlined in Table No.16.

Table 16. Permissible values of air emissions according to AI/No. 07/2021

PARAMETERS	PERMISSIBLE VALUE ACCORDING TO AI/No. 07/2021
Dust	20 mg/nm^3
SO_2	400 mg/nm^3
NOx	400 mg/nm^3

According to the data from the Department of Environmental and Water Protection, there are approximately 25 operators equipped with Integrated Environmental Permits that operate in various regions and activities. The number of economic operators that reported to the KEPA during the year 2022 was relatively small. Economic operators such as: KEK (without an Integrated Environmental Permit), Feronikel, and Sharrcem have reported on a monthly basis depending on the production process. Partial reports have been submitted by other operators such as Brickos, Bitex, and New Co Balkan.

3.1. Assessment of air emissions by the Kosovo Energy Corporation

Photo 2. The Kosovo Energy Corporation - Obiliq, (T.Veselaj, 2022)

According to the data from monthly environmental reports submitted by the KEC (TPP A&TPP B), the monitoring of air emissions for the year 2022 was carried out of the following parameters: total dust emission, SO_2, NO_X, which request derives from the national and European legislation.

In TPP “Kosova-A”, the parameters of SO_2 and NOx are calculated (except for the dust emission, which is measured), while in TPP “Kosova-B” all parameters are calculated.

In TPP A3, A4, and A5, there have been installed devices for continuous monitoring of dust particles emissions (the measurements are debatable due to the poor maintenance of the measurement devices).

In TPP “Kosova-B”, there have been installed devices for continuous measurement of dust emissions, SO_2, NOx, which are currently not operational. Therefore, there are still calculated the emissions of dust and gases discharged.

Dust Emissions in TPP-Kosova A and B

It has been assessed that the dust emissions released during the operation in TPP-Kosova A&B have exceeded the permissible environmental limits. The exceedances of dust emissions from TPP-Kosovo B have been significantly higher throughout the year when compared to TPP A. See fig.29.

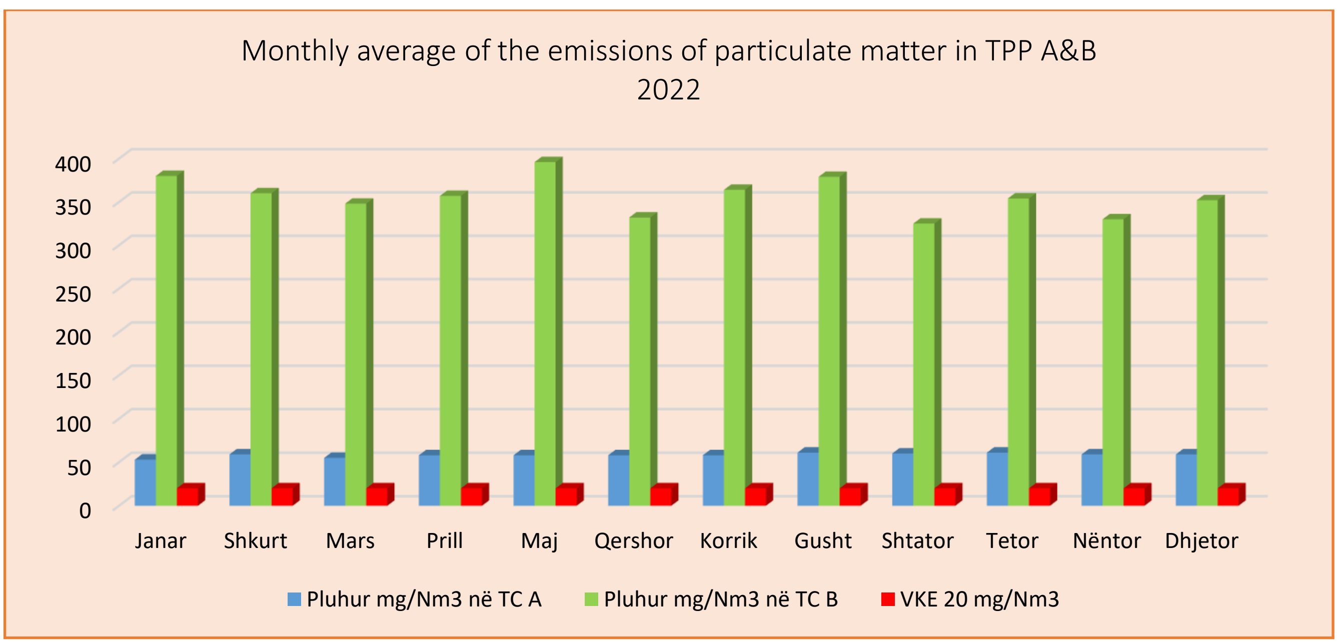

Fig.29. Dust emissions in TPP A&B 2022

Emissions of SO_2 in TPP-A&TPP-B

Emissions of SO_2 in TPP-A and TPP-B, according to the data assessments, there is noticed an exceedance of the values of the emissions released according to the permitted standards. Exceedances were recorded in both thermal power plants (TPP-A and TPP-B) during the months of January - December 2022 (fig. 30).

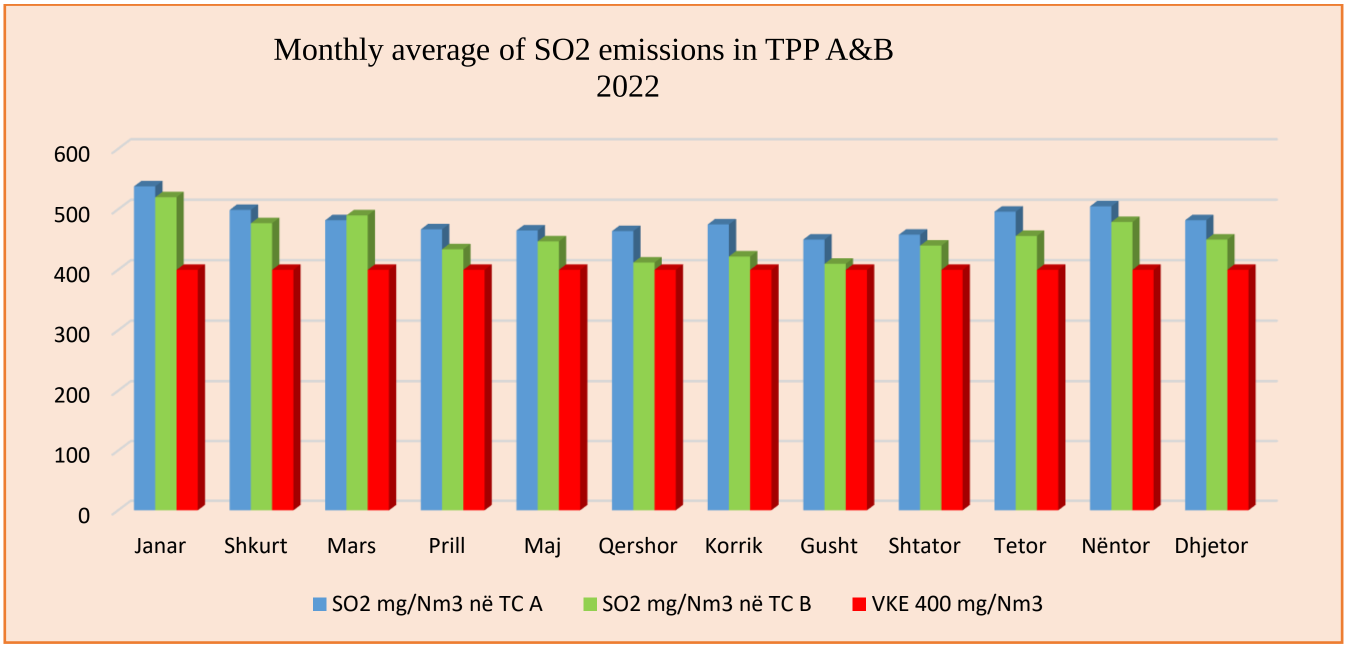

Fig. 30. SO2 emissions in TPP A&B, 2022

NOx emissions in TPP- A&B

Throughout the year, both thermal power plants had exceedances of the permissible limit values of NOx emissions into the air. In TPP-A, during the first seven months of the year, it was observed a higher limit of NOx emissions, reaching 600 $mg/\ Nm^3$ which decreases in August and September. These values again increase in October, November, and December. In TPP-Kosovo-B, there were recorded higher values of exceedances during the months of January and May 2022 (fig.31.).

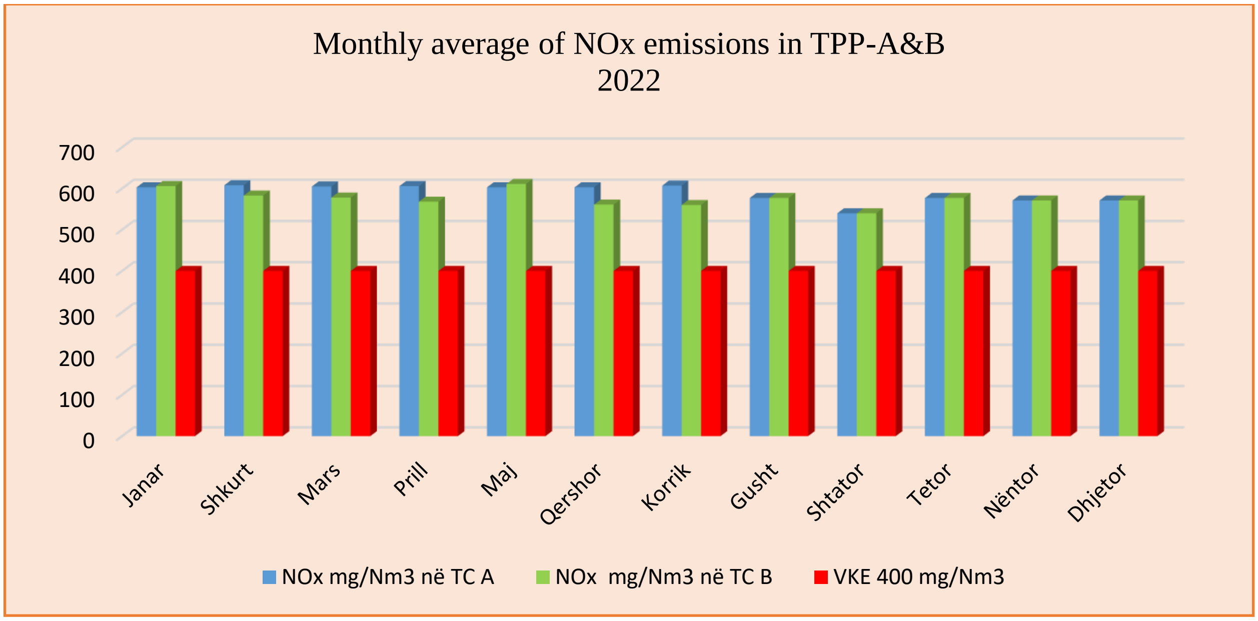

Fig.31. NOx emissions in TPP-A&B, 2022

3.2. The assessment of emissions at the New Co Feronikeli

Foto 3. The operator New Co Feronikel-Drenas,(A.Buçinca, 2022)

In the Environmental Report of the year 2022, prepared by the Department of Environment and Quality Control, there have been included environmental data from the environmental monitoring in the New Co Ferronikeli Complex LLC industrial complex.

For this industrial complex, compliance with Directive 200/80/EC and national legislation IA/No.07/2021 regarding the rules and norms for air emissions from stationary pollution sources, the permissible values according to environmental emission standards are presented in table No.17.

Table 17. Permissible values of air emissions according to AI/No.07/2021.

PARAMETRES	PERMISSIBLE VALUE ACCORDING TO IA/No.07/2021.
Dust	20 mg/Nm^3
SO_2	400 mg/Nm^3
NOx	400 mg/Nm^3
CO	800 mg/Nm^3

The Department of Environment and Quality Control of the New Co Ferronikeli Complex LLC has reported measurements from the continuous monitoring system for air emissions in:

- The stack of the rotary furnace,
- The stack of the converters, and
- The stack of the Electric Furnace 2.

The industrial operator New Co Ferronikeli operated partially during the year (March-July 2022), and the assessment of the condition was analyzed only for the operator’s operational period. Based on this data assessement, it is estimated that these data are insufficient to reflect the actual condition for air emissions in the environment throughout the year 2022

The stack of the Rotary furnace

Dust emissions in the rotary furnace

The average monthly values of dust emissions from the rotating furnace indicate that there were exceedances of the permissible limit values during the time when the operator was operating (May-July 2022) (fig.32).

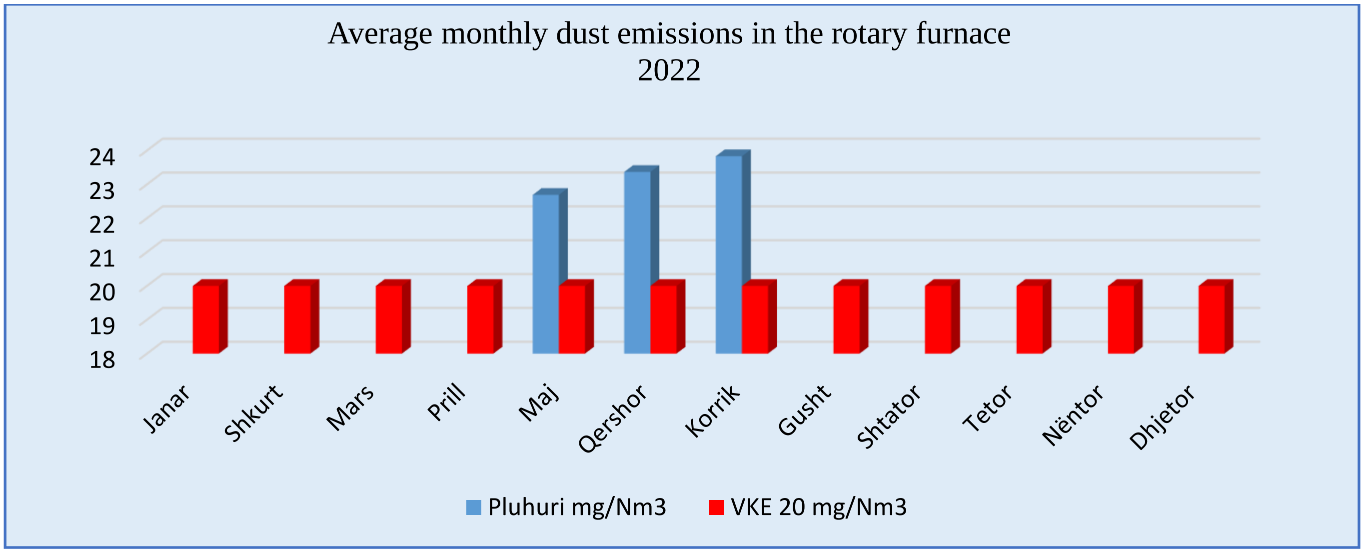

Fig.32. Rotary Furnace Dust Emissions (May-July), 2022

CO emissions in the rotary furnace

Average monthly values of CO in the rotary furnace show that there were no exceedances of the permissible values for the period of operation (May - July 2022) (fig.33).

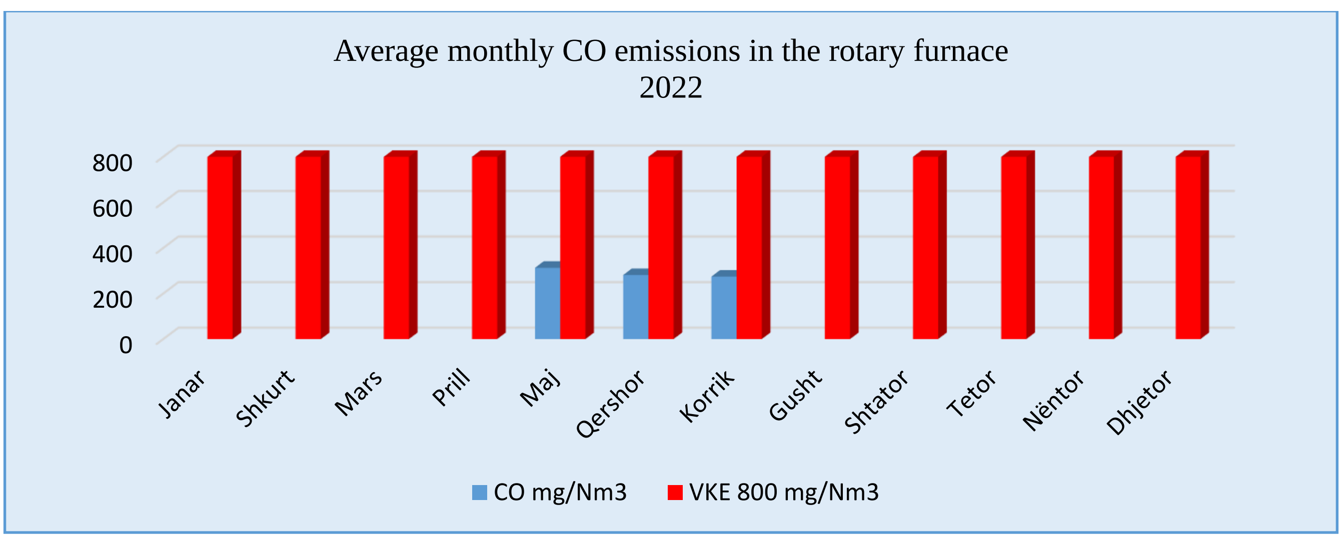

Fig.33. Rotary Furnace CO emissions (May-July), 2022

SO_2 emissions in the rotary furnace

In the rotary furnace, the monthly average value of SO_2 shows that in the month of July there was exceedance of the permissible limit values (fig.34).

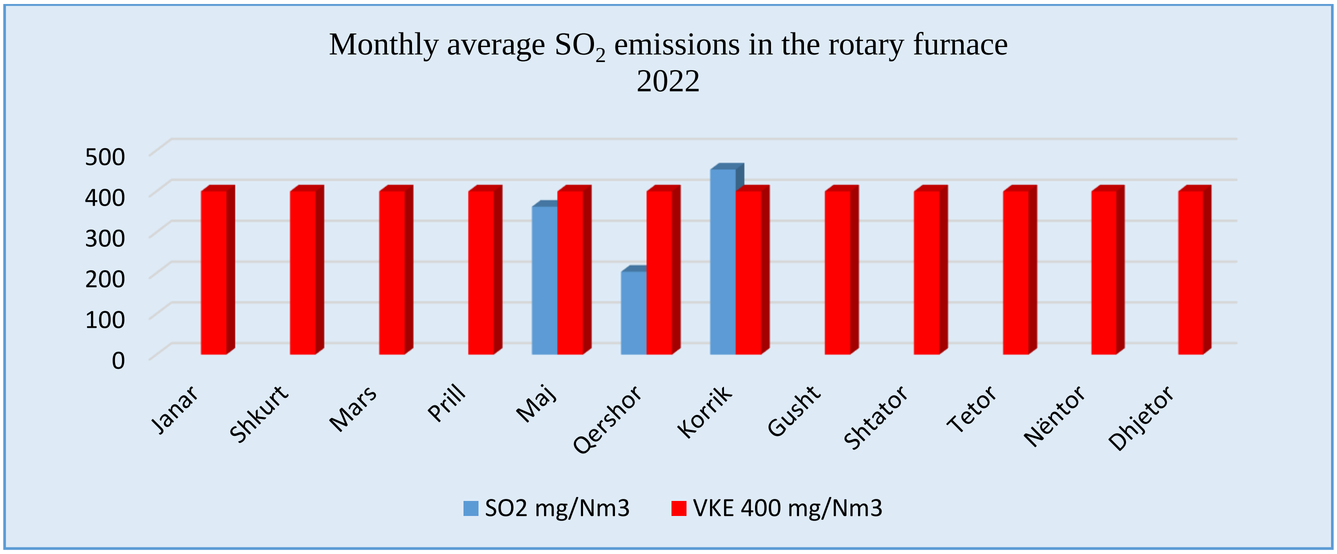

Fig.34. Rotary furnace SO_2 emissions (May-July), 2022

NO_2 emissions in the rotary furnace

The average monthly values of NO_2 in the rotary furnace show low values compared to the permissible limit values during operation in the months of May-July 2022 (fig. 35).

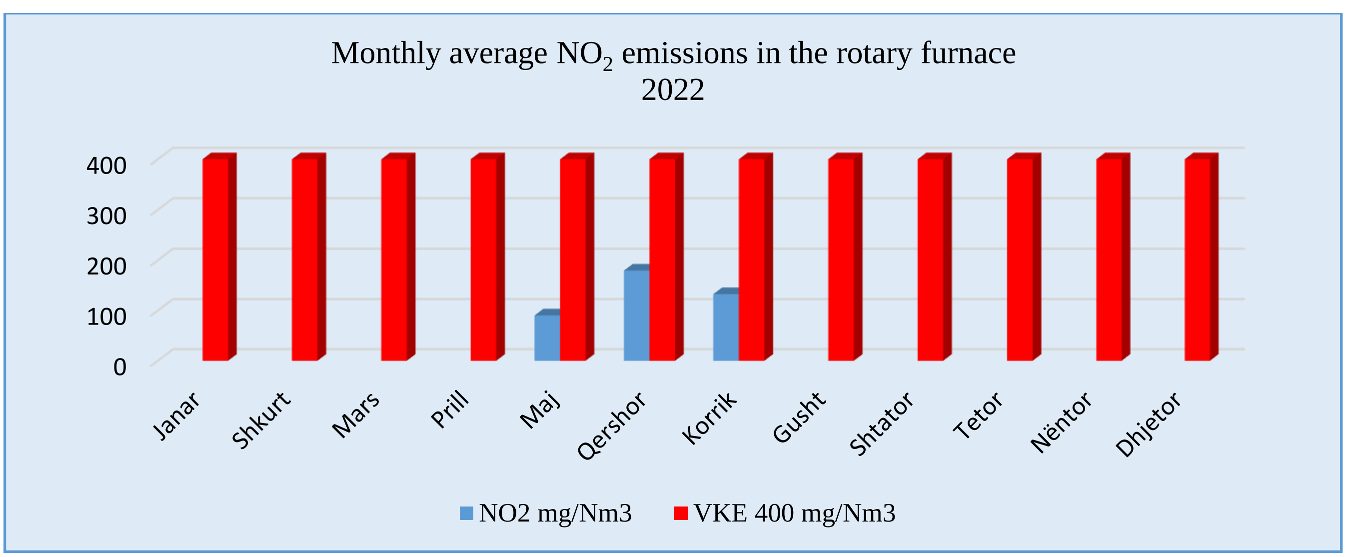

Fig.35. NO_2 emissions in the rotary furnace (May-July), 2022

Converter stack

Dust emissions in the converter

In the converter stack, the dust emissions during the month of June show that there was exceedance of the permissible limit values (fig. 36).

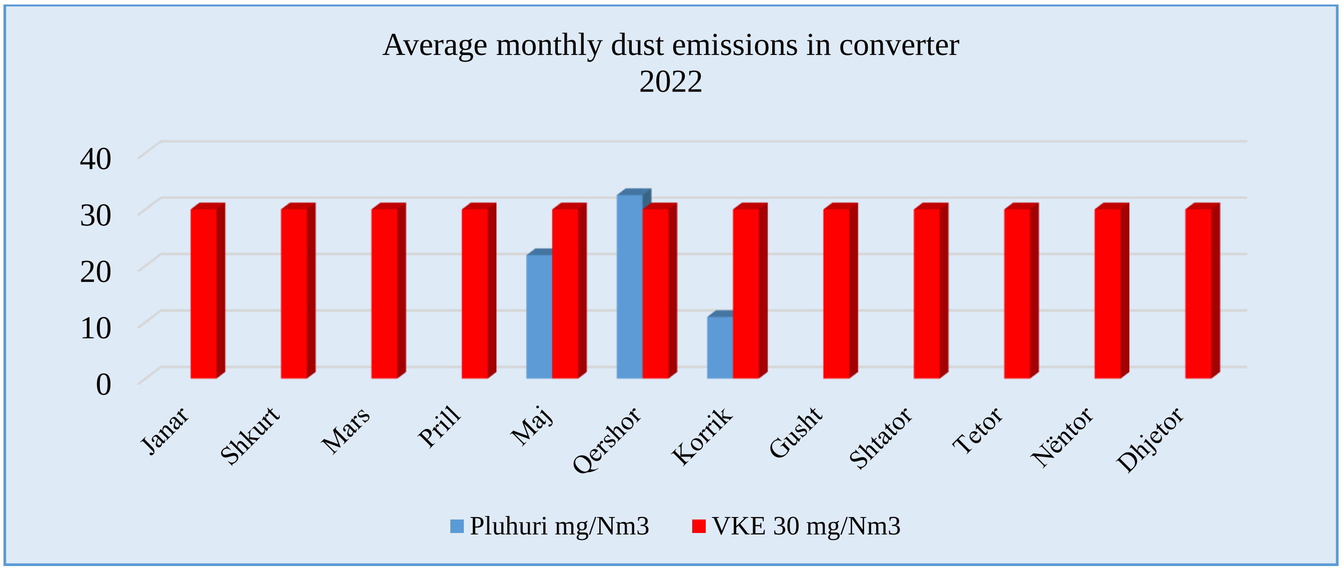

Fig.36. Dust emissions in Converter (May-July), 2022

CO emissions in the converter

The average monthly value of CO in the converter shows that they are much lower compared to the permissible values according to the standard. See fig. 37.

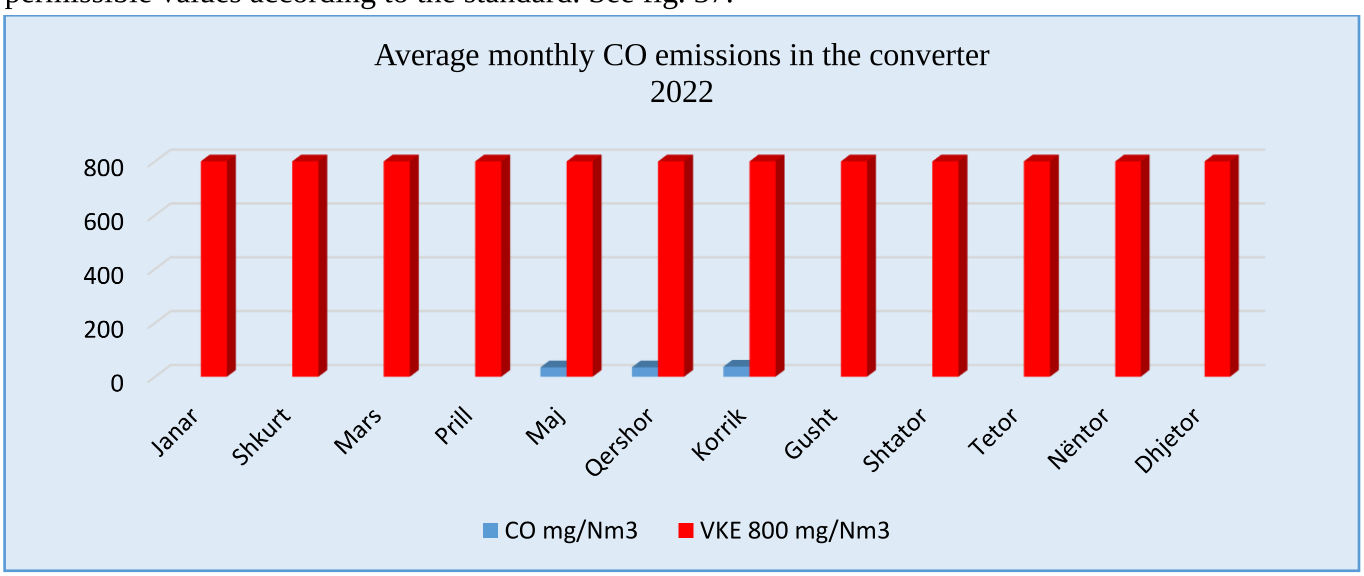

Fig.37. CO emissions in the Converter (May-July), 2022

SO_2 emissions in the converter

In the converter, the average values of SO_2 emissions have shown lower values according to the standards permissible for discharge (fig. 38).

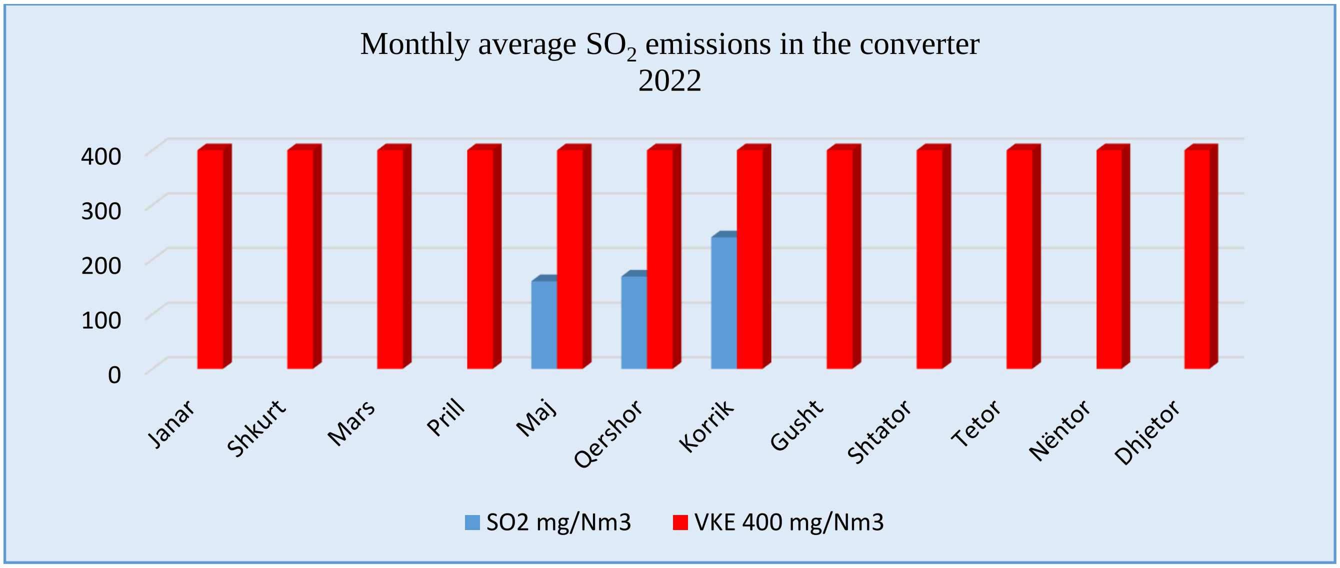

Fig.38. SO_2 Emissions in Converter (May-July), 2022

NO_2 emissions in the converter

In fig.39, there are presented the average monthly values of NO_2 in the converter, where it can be observed that there were no exceedances of the permissible limit values during the months in the process of operation (March - July 2022).

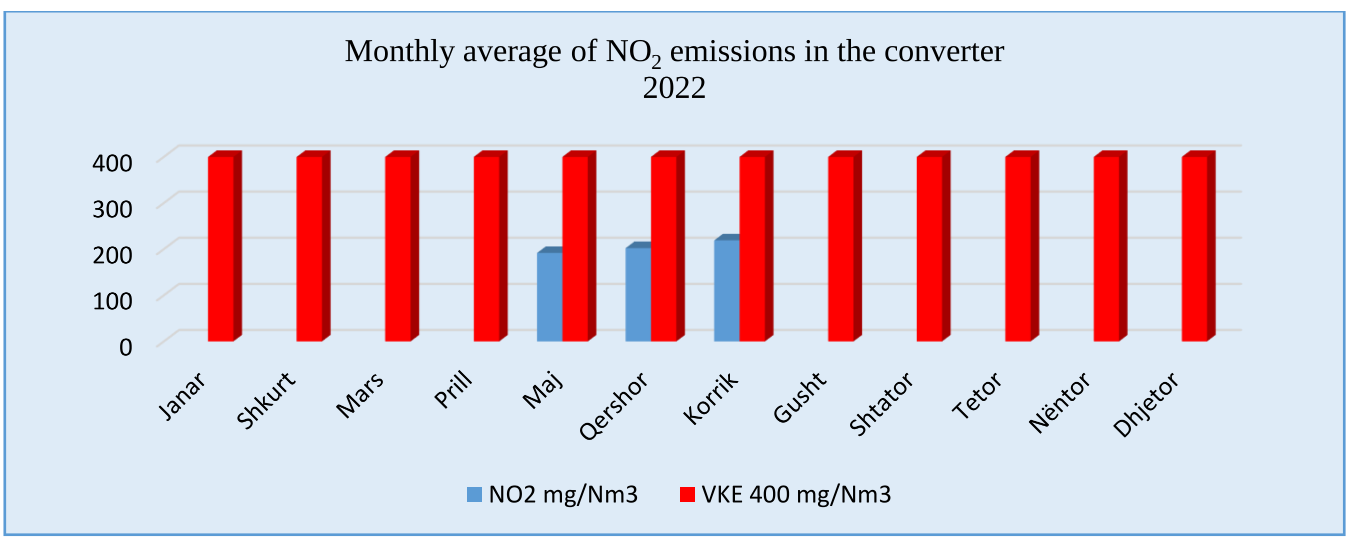

Fig.39. NO_2 emissions in the converter (May-July), 2022

Electric furnace No. 2

Dust emissions in the electric furnace No. 2

Dust emissions in the electric furnace No. 2, it is observed that there were no exceedances of the permissible values, during (May - July 2022) (fig. 40).

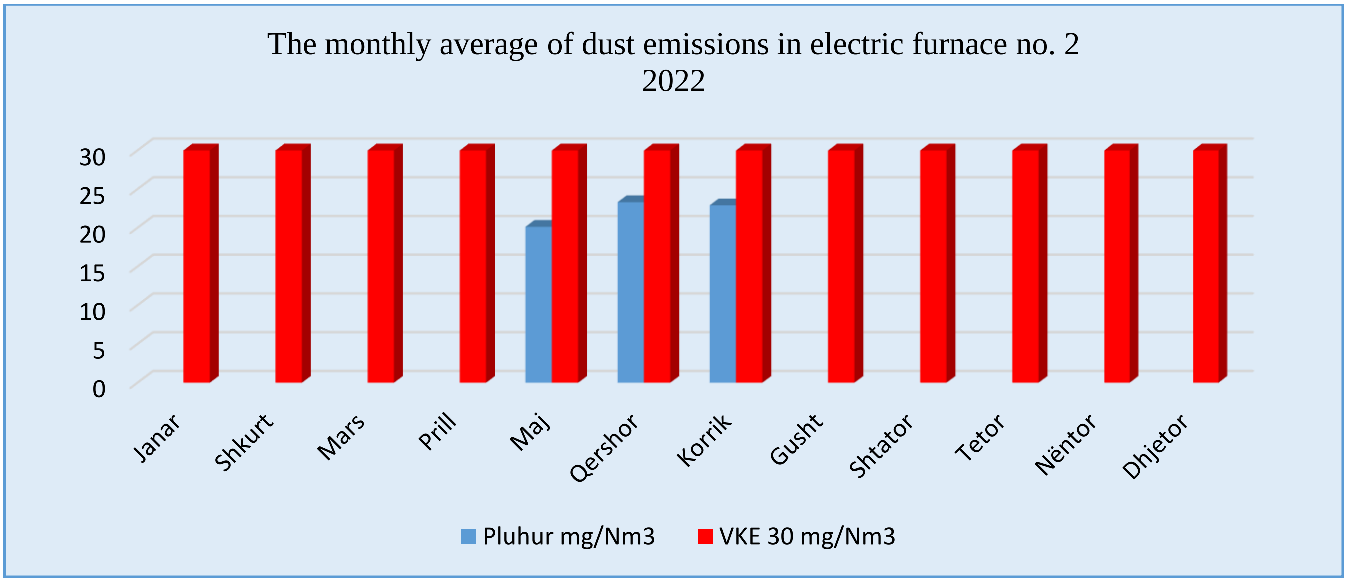

Fig.40. Dust emissions in the Electric Furnace No. 2. (May-July), 2022

3.3. Assessment of air emissions by the industrial operator Sharrcem

Photo 4. The operator of Sharrcem-Hani i Elezit, (H.Berisha, 2022)

Dust Emissions

Dust emissions from the industrial operator Sharrcem are monitored from two discharge sources:

- Dust emissions from the raw material kiln - mill;
- Dust emissions from the clinker cooler and cement mill.

Dust emissions from the raw material kiln - mill

The monthly average values of dust emissions from the raw material kiln - mill at Sharrcem, during the months of January to December 2022, the levels of this pollutant are significantly lower compared to the emission limit value (ELV). See fig.41.

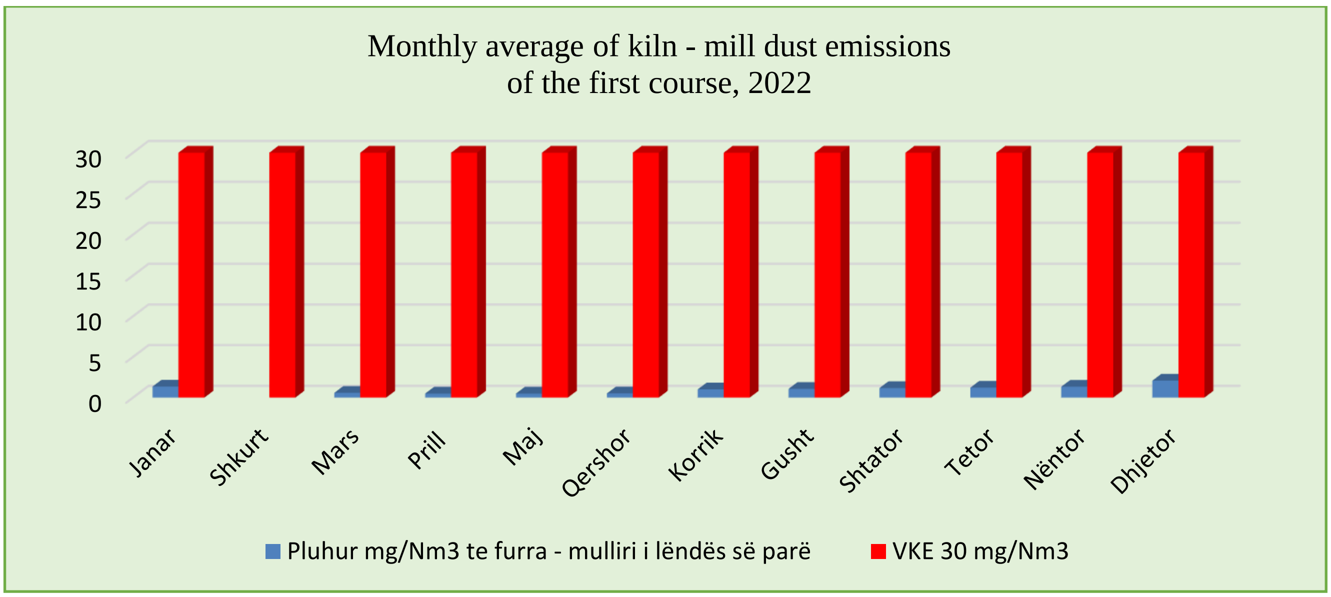

Fig.41. Kiln dust emissions - raw material mill, 2022

Dust emissions of the clinker cooler and cement mill

At the clinker cooler and the cement mill, the average monthly values of dust emissions during the operation of the operator show that dust emissions to the air are very low compared to the permissible emission limit values in the air (ELV). The ELV for dust emissions is set at 20 mg/Nm^3.

Clinker cooling dust emissions have shown higher values than the cement mill except in February 2022 (fig. 42).

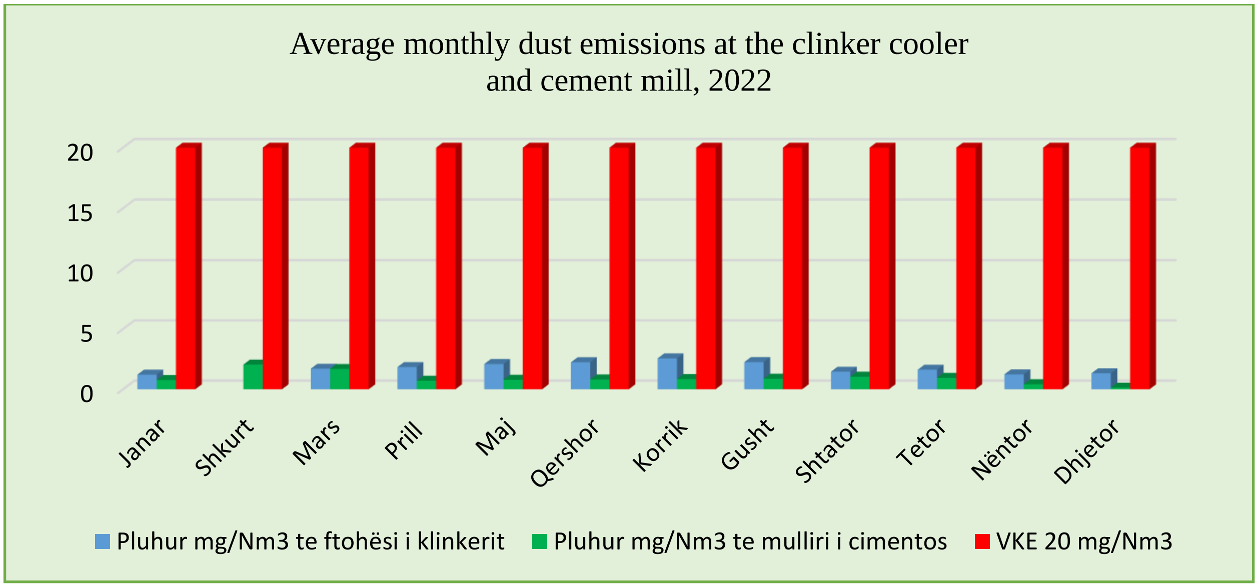

Fig.42. Clinker Cooler and Cement Mill Dust Emissions, 2022

SO_2 emissions at the furnace - raw material mill

The average values of SO_2 emissions in the furnace - mill of the material show that there were no exceedances of the limit values of emissions released into the air (ELV). There was an increase in the higher values of SO_2 during the months of August-December 2022 (fig. 43).

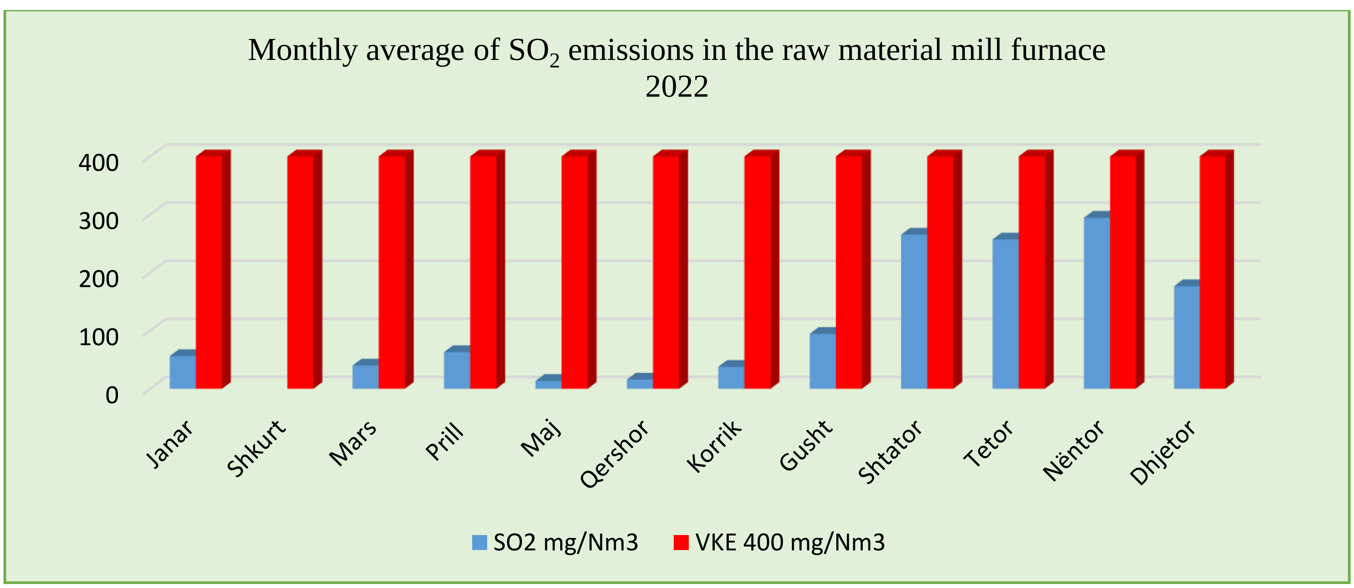

Fig.43. SO_2 emissions of furnaces - raw material mills, 2022

NOx emissions at the furnace - raw material mill

The average monthly values of NOx emissions at the furnace - raw material mill, during the months of July, August, September and December there were exceedances of the permissible limit values for air emissions (fig. 44.)

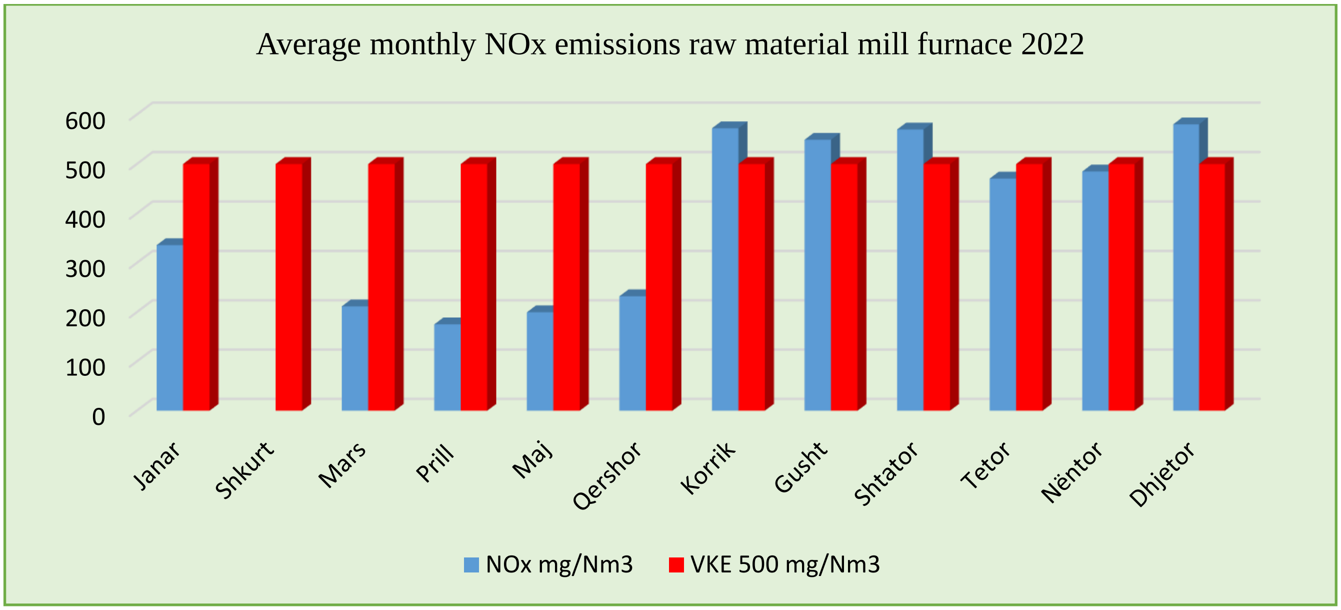

Fig.44. NOx emissions at the furnace - raw material mill, 2022

4. Operators in possession of Integrated Environmental Permits

According to the data provided by the Department of Environmental and Water Protection, a total of 25 operators are equipped with Integrated Environmental Permits which operate in various activities. All these operators are required to prepare monthly reports and self-assessments for their environmental discharges. During the year 2022, the economic operators such as KEC, Feronikel, Sharrcem, and other related operators like Brickos, Bitex, and New Co Balkan have reported to the Environmental Protection Agency (EPA) (Table 18).

Table 18. Operators with activity extensions in the municipalities of Kosovo equipped with integrated environmental permits

No.	The operators in the municipalities	SUBJECT/ ACTIVITY
1.	Gllogoc	Production of Ferronickel
2.	Hani Elezit	Cement production
3.	Lipjan	Refinery plant for petroleum derivatives
4.	Suharekë	Factory for the production of paints, facades, and varnishes
5.	Prizren	Factory for the production of clay blocks
6.	Podujevë	Factory for the production of clay blocks
7.	Ranillug	Factory for the production of clay blocks
8.	Obiliq	Factory for the production of clay blocks
9.	Krushë e Vogël, Prizren	Factory for the production of clay blocks
10.	Fushë Kosovë	Factory for the production of paints, facades, and varnishes
11.	Sankoc, Gllogoc	Metal waste smelting (Annex to the existing permit)
12.	Gjakovë	Factory for the production of clay blocks
13.	Vushtrri	Factory for the production of paints
14.	Graçanicë	Factory for the production of paints, facades, and varnishes
15.	Gllogoc	Slag landfill, Çikatovë e Vjetër (Annex to the existing permit)
16.	Gllogoc	Disposal of general medical, medicinal, and organic waste (Annex to the existing permit)
17.	Vushtrri	Factory for the recycling of used oils
18.	Gllogoc	Exploitation of Ferronickel slag, Gllavica Mine in Medveđa, Municipality of Lipjan
19.	Korroticë e Epërme, Gllogoc	Factory for the production of medicines

20.	Rrezinë, Gjakovë	Military poultry farm
21.	Suharekë	Production of conveyor belts and rubber straps
22.	Prizren	Factory for galvanizing metals with zinc
23.	Pejë	Production of paints, facades, and varnishes
24.	Banjë, Vushtrri	Factory for the recycling of waste oils, fats, and petroleum (Annex to the existing permit)
25.	Landovicë, Zona kadastrale Piranë, Prizren	Production of Ferronickel

5. The Impact of Air Pollution on Health

Air pollution damages the quality of life for each individual. Air pollution and human body exposure, depending on the health condition, can lead to impaired lung function, respiratory organ infections, lung cancer, asthma onset and exacerbation, a sense of disharmony between the body and the environment, and so on. A part of the society still lives in unfavorable socio-economic conditions, indicating that this group may be more affected due to the lack of financial resources for healthcare and living in close proximity to areas with poor air quality. Reference values for air quality set by the WHO, which are acceptable for their impact on health, can be found in Table 19.

Table 19. WHO Air Quality Guidelines and Assessed Reference Levels.

Pollutants	Average period	Reference levels	Comments
PM_{10}	1 day Year	50 μg/m^3 20 μg/m^3	99%(3 days per year)
$PM_{2.5}$	1 day Year	25 μg/m^3 10 μg/m^3	99%(3 days per year)
O_3	Maximum 8-hour daily average	100 μg/m^3	-
NO_2	1 hour	200 μg/m^3 40 μg/m^3	-
SO_2	1 minute 1 day	500 μg/m^3 20 μg/m^3	-
CO	1 hour Maximum 8 hours per day	30 μg/m^3 10 μg/m^3	-

During the year 2022, the European Environment Agency (EEA) published the report "Air Quality in Europe 2022, Health Impact of Air Pollution." The report refers to air quality monitoring data from the national network managed by HMIK and also provides an assessment of the health impact of air pollution for Kosovo. According to the report, exposure to $PM_{2.5}$ concentration was associated with 359 premature deaths. Exposure to NO_2 concentration was associated with 264 premature deaths, while exposure to O_3 concentration was associated with 135 premature deaths.

Table 20: Association of Premature Deaths with Air Pollution Concentration Levels.

	Kosovo	EU 27	Europe Totally
Population (x1000)	1.782	442.650	530.892
Annual average µg/m3 (PM2.5)	19.40	11.20	11.40
Premature death (PM2.5)	3,059	237,810	274,673
Annual average µg/m3 (NO2)	14.40	14.10	15.70
Premature death (NO2)	264	48,555	64,312
Annual average µg/m3 (O3)	3,901	4,182	4,229
Untimely Death (O3)	135	24,109	28,337

6. Conclusions and Recommendations

6.1. Conclusions

- Data from the monitoring for the year 2022 indicate exceedances of the maximum permissible values for several parameters, particularly for PM_{10} and $PM_{2.5}$, mainly during the winter season.
- In the Agglomeration Zone (AKS1), there were recorded 152 days with exceedances of the values for PM_{10}, while in Zone ZKS1, there were 147 days with exceedances.
- The monthly average values with exceedances of PM_{10} in the Zone AKS1 were recorded at the Rilindja station, while the values with exceedances of $PM_{2.5}$ were recorded at the monitoring stations HMIK/Prishtina, Rilindja/Prishtina, Obiliq, and Dardhishtë/Obiliq.
- In Zone ZKS1, exceedances of PM_{10} values were only recorded at the Gjilan station, while exceedances for $PM_{2.5}$ were recorded at the stations Drenas, Mitrovica, Peja, Prizren, Hanë të Elezit, and Gjilan.
- At Thermo Power Plants A&B, pollutant emissions released such as dust, SO_2, and NO_X were recorded above the permissible values throughout the year.
- The Ferro-nickel operator was in operation for only three calendar months in 2022. The highest emissions were recorded for dust and SO_2.
- For the Sharrcem operator, the highest emissions exceeding the permissible limits were recorded for NO_X pollutants.
- During the year 2022, the Economic Operators such as KEC Feronikel, Sharrcem, and partially the operators Brickos, Bitex, and New Co Balkan reported to KEPA. The number of operators in possession of Integrated Environmental Permits is 25.
- According to the assessment by the European Environment Agency (EEA), exposure to $PM_{2.5}$ concentration was associated with 359 premature deaths. Exposure to NO_2 concentration was associated with 264 premature deaths, while exposure to O_3 concentration was associated with 135 premature deaths.
- The implementation of laws, sublegal acts, and policies for the air sector, such as those regarding emissions control from mobile sources and quality control of oil, is considered at unsatisfactory level.
- A low level of enforcement of legal requirements is also at the local level.

6.2. Recommendations

Based on the findings of the report, KEPA has issued several recommendations for reducing pollution and strengthening the air sector.

- The Strategy and the Action Plan on Air Quality should be reviewed and approved by the Government of Kosovo and the Assembly of Kosovo;
- Municipalities should develop Local Action Plans on Air Quality, in accordance with the obligations stipulated in the Law No. 03/L-160 on air protection from pollution;
- There should be completed the sub-legal basis with the requirements of the Law No. 03/L-160 on air protection from pollution;
- There should be enhanced the effectiveness of the environmental legislation enforcement through supplementary mechanisms and instruments;
- There should be improved the cooperation between monitoring institutions and operators, particularly in terms of information flow, processing, reporting, and effective public communication regarding air quality;
- There should be drafted favorable policies for the use of fuels that have lower emissions and the implementation of clean technologies in production processes;
- There should be encouraged the utilization of alternative transportation with lower air emissions, and there should be implemented temporary restrictions on the use of old vehicles and vehicles without catalytic converters;
- There should be implemented sub-legal acts on permissible emission standards from mobile and stationary sources;
- There should be strengthened inspection at both central and local levels to ensure compliance with air emission standards by polluting operators;
- Polluting operators without Environmental Permits should be obliged to undergo the necessary procedures to obtain the respective permits;
- Gas emission control should be mandatory for Technical Inspection Centers, in accordance with relevant legislation acts;
- Promotion and implementation of clean technologies in industrial processes to reduce air emissions;
- Enhancement of the energy efficiency in buildings and increase of the green spaces;
- The budget for air quality improvement and pollution reduction should be increased.

7. List of abbreviations, figures, and tables

7.1. List of abbreviations

MESPI - Ministry of Environment, Spatial Planning, and Infrastructure
KEPA- Kosovo Environmental Protection Agency
HMIK - Hydrometeorological Institute of Kosovo
TPPA - Thermal Power Plant Kosova A
TPPB - Thermal Power Plant Kosova B
AQI - Air Quality Index
EU - European Union
WHO - World Health Organization
EEA - European Environment Agency

7.2. List of figures

7.3. List of tables

7.4. List of photos

7. Annexes

Annex 1: Air quality standards according to the Administrative Instruction No. 02/2011

Parameter	Permissible values	The measure	Limit value (limit) µg/m3	Allowed overruns within the year
NO_2	Limit value for 1 hour, for the protection of human health	$\mu g/m^3$	200	18
	Annual limit value, for the protection of human health	$\mu g/m^3$	40	It is not foreseen
	Annual limit value, for the protection of vegetation	$\mu g/m^3$	30	It is not foreseen
SO_2	Limit value for 1 hour, for the protection of human health	$\mu g/m^3$	350	24
	Limit value for 24 hours, for the protection of human health	$\mu g/m^3$	125	3
CO	Limit value for the daily average of the 8-hour maximum, for the protection of human health	mg/m^3	10	It is not foreseen
PM_{10}	Limit value for 24 hours, for the protection of human health	$\mu g/m^3$	50	35
	Annual limit value, for the protection of human health	$\mu g/m^3$	40	It is not foreseen
$PM_{2.5}$	Annual limit value, for the protection of human health	$\mu g/m^3$	25	It is not foreseen
O_3	The long-term objective is to protect human health	$\mu g/m^3$	120	It is not foreseen

Appendix 2: Air Quality Index

Quality	Good	Acceptable	Average	Poor	Very poor	Extremely poor
Particles of dust smaller than 2.5 µm ($PM_{2.5}$)	0-10	10-20	20-25	25-50	50-75	75-800
Particles of dust smaller than 10 µm (PM_{10})	0-20	20-40	40-50	50-100	100-150	150-1200
Nitrogen dioxide (NO_2)	0-40	40-90	90-120	120-230	230-340	340-1000
Ozone (O_3)	0-50	50-100	100-130	130-240	240-380	380-800
Sulfur dioxide (SO_2)	0-100	100-200	200-350	350-500	500-750	750-1250
Air Quality Index level (based on pollutant concentration, expressed in $\mu g/m^3$)						

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has been prepared by the Sector for Environmental State Assessment
Directorate for Environmental State Assessment
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