Engineering Applications

https://publish.mersin.edu.tr/index.php/enap

e-ISSN 2979-9201

Health risks from air pollution from vehicles in the city of Tirana

Asllan Hajderi [*1], **Ledia Bozo** [2]

[1] *Albanian University, Department of Engineering, Albania, a.hajderi@albanianuniversity.edu.al*
[2] *University of Tirana, Department of Informatics, Tirana, Albania, lediabozo@gmail.com*

Cite this study: Hajderi, A., & Bozo, L. (2024). Health risks from air pollution from vehicles in the city of Tirana. Engineering Applications, 3(1), 68-77

Keywords
Air pollution from vehicles
Pollution measurement
Air quality indicators
Health risk

Research Article
Received: 15.08.2023
Revised: 06.01.2024
Accepted: 10.02.2024
Published:16.02.2024

Abstract

Air pollution from vehicles in the city of Tirana has become a worrying problem for the health of the residents. In this regard, the challenge for human health remains the improvement of air quality. For this purpose, in the beginning the main elements of air pollution and their sources were treated. Then the effects of the main pollutants on human health were treated, where the most dangerous for the city of Tirana are particles matter, nitrogen oxides and ozone. Then the measurement of pollution for the main pollutants and the ways of determining the air quality were treated, continuing with the assessment of the health risks coming from the main pollutants, where according to the WHO, premature deaths, lost years of life and morbidity are used. In 2020 for Albania, we had 3600 premature deaths from particles matter, 330 from nitrogen dioxide and 310 from ozone. While the lost years of life per 100,000 inhabitants were 1296 for particles, 116 for nitrogen dioxide and 115 for ozone. At the end, discussions on the ways to reduce the health risks associated with the reduction of air pollution from vehicles, are given, by strengthening the technical control of vehicles and the use of efficient methods of cleaning the fuel system and the use of biodiesel and alternative fuels.

1. Introduction

With the development of industry and the concentration of human habitation in large cities, air pollution has become a deadly intimidation to humans. By air pollution in the world accounts for about 7 million premature deaths every year [1]. Most at risk from air pollution are those areas where the population density is very high, such as in big cities. According to the WHO, the biggest culprits for air pollution are vehicles [2-3].

Air pollution directly affects in human health. With every breath we take, we inhale tiny particles that can damage our lungs, heart and brain and cause a host of other health problems.

Thus, in Europe the premature deaths calculated for 2020 attributable to exposure, above the WHO guideline level of 2021, according to the type of pollutants [1] are:

- Concentrations of PM 2.5 above 5 μg/ m^3 have caused 275,000 premature deaths
- Concentrations of NO_2 above 10 μg/ m^3 have caused 64,000 premature deaths
- Ozone concentrations above 70 μg/m have caused 328,000 premature deaths

Meanwhile, in addition to premature death, air pollution causes several diseases that make people unable to work. This is a burden that brings personal suffering, but also significant costs for the health care sector.

Thus in 2019, 31 European countries exposure to NO_2 led to 175,070 years of life with disability (YLD) due to diabetes mellitus.

In the same year, in 23 European countries 12,253 people were hospitalized with lower respiratory tract infections and chronic pulmonary disease as a result of ozone exposure [2].

This is why in 2021, the WHO updated its guidelines for air quality by halving the previous level of 2005 norms [4]. Therefore, today's challenge for human health remains the improvement of air quality.

In Albania, the city of Tirana faces the most serious air pollution, due to heavy vehicle traffic, but also the density of residential development.

The city can now be considered a problematic area for the content of fine particles of soot (PM) and nitrogen dioxide and a number of other pollutants, but the PIH, which has the task of protecting health, does not provide regular information to the public [4].

Meanwhile, in April 2023, the problem of exceeding the pollution from nitrogen oxides and benzene in the city of Tirana was raised 2-4 times over the allowed values.

Based on the importance of air pollution in human health, I undertook the task of analyzing air pollution from vehicles and health risks for people in the city of Tirana, with the aim of improving air quality. and reducing health risks to humans.

2. Material and Method

For the realization of the study, the method of analysis of the polluting elements released by the vehicles and the harmful effects on the human body was used. The study used the theoretical methods of measuring pollution and calculating air quality indicators, as well as information on pollution levels and health risks from reports published in Albania and European countries to extract the data for Albania.

2.1. The main elements of air pollution from vehicles

According to the WHO, vehicles are the biggest culprits of air pollution [1,3]. The main sources of air pollution come from vehicles and are [3-13]:

Carbon monoxide (CO) is a tasteless, colorless and odorless gas. The main source is the vehicles. It created from incomplete combustion of fuels in the engine and the highest concentrations are found near major roads and intersections.

Hydrocarbons (HC) are parts of unburned fuel, which react in the presence of nitrogen oxides and sunlight to form ozone at ground level, which is a major component of smog.

Fine particles, PM2.5/ PM 10. come mainly from cars with diesel engines. Particulate matter is the unburned carbon or soot that comes out of diesel engines.

Nitrogen oxides (NO_x) are formed from nitrogen and oxygen atoms under conditions of high pressure and temperature in the engine. It consists of nitrogen monoxide (NO) and nitrogen dioxide (NO_2). In the presence of sunlight, it helps in the formation of terrestrial ozone.

Benzene (C_6H_6) is an aromatic hydrocarbon. There are many sources, but the main one remains the burning of fuels from vehicles.

Carbon dioxide (CO_2) is produced by burning fossil fuels, such as coal, oil, gasoline, natural gas. The main source is transport vehicles, electricity production, etc. Carbon dioxide emissions contribute to climate change. Until 1995 this was considered not as a pollutant but as a perfectly burning fuel.

Ozone (O_3) is a very reactive gas that exists in the lower part of the atmosphere (ground level) but also in the troposphere. It is not caused directly by vehicles, but is formed by chemical reactions between other pollutants, initiated by strong sunlight.

Sulfur dioxide (SO_2) is a very toxic, colorless, non-flammable gas. It is formed when fuel contains sulfur.

2.2. Harmful effects of air pollution on human health

Among the effects of air pollution caused to human health, according to pollutants, we have [4,14-17]:

Carbon monoxide easily combines with oxygen in red blood cells to form carbon dioxide, preventing the supply of oxygen to the human body and brain. This paralyzes muscles and all organs and in high concentrations is extremely dangerous poison. Symptoms from Carbon monoxide are : mental confusion, vomiting, loss of muscle coordination, loss of consciousness. Even the doctor confuses it with a virus. Staying longer eventually results in a pleasant death (EU norm is 10 mg/m^3).

Hydrocarbons are partially poisonous, some with the potential to cause cancer. Breathing aromatic hydrocarbons in high concentrations for long periods of time causes fatigue, headaches, dizziness and vomiting. (EU norm is 1 mg/m^3).

Fine particles, PM2.5/PM10 cause respiratory and heart diseases, other harmful health effects and death [18-22]. Long-term exposures contribute to lung cancer. According to the WHO, it is considered the most dangerous pollutant for human health. (EU norms PM2.5 is 10 $\mu g/m^3$).

Nitrogen oxides are active poisons, which cause irritation of the respiratory tract, when it is at a concentration greater than 150 ppm. Nitrogen dioxide can cause lung disease, inflammation in the respiratory tract and problems in the functioning of the lungs (EU norm is 40 $\mu g/m^3$).

Carbon dioxide concentration of 10% or more causes death, unconsciousness or convulsions and may harm a developing fetus. It can also cause hyperventilation, visual impairment, lung congestion, central nervous system damage, muscle contractions, high blood pressure, and shortness of breath. (EU norms is 2 $\mu g/m^3$).

Benzene increases the risk of cancer and other diseases, and is a cause of bone damage. (EU norm is 5 $\mu g/m^3$).

Ozone in the air can harm our health, especially on hot sunny days, when it reaches unhealthy levels. Ozone irritates the eyes, nose, throat and damages the lungs. Ozone in the upper atmosphere is beneficial because it blocks harmful ultraviolet rays that contribute to skin cancer. (EU norm is 100 μg/m^3).

Sulfur dioxide causes breathing difficulties, inflammation of the respiratory tract, eye irritation, weakening of the heart. Sulfur dioxide is also linked to asthma, chronic bronchitis and death in elderly people and infants (EU norm is 125 μg/m^3).

For the protection of air from pollution in Albania have been defined law [10] and guideline of MPPT [9].

2.3. Measurement of air pollution and determination of air quality

Depending on the main sources of emissions, pollution measurement stations are classified [3, 15]:
- mobile stations located near a main road
- industrial stations located near an industrial area or an industrial resource
- stations where average pollution levels are taken.

For major pollutants, monitoring stations must meet the criterion of reporting more than 75% of valid data from all possible data in a year

Air pollution stations are often attached to weather stations and sometimes to traffic camera networks. Each air pollution station collects sensor data and records it as a set. All stations are defined by Sensor ID, Sensor Code, Sensor Name, Position, Latitude, Longitude and Altitude. Data is often recorded by date and time. Each camera is identified by Camera ID, Camera Code, Camera Name, Latitude, Longitude. All data is transmitted and can be accessed through the website and protocol provided, to all employees and interested parties.

Automatic and diffusion tube stations are used for air quality monitoring. In the city of Tirana, two automatic stations brought in May 2010 by the German government and WHO are used for PHI and stations with diffuse tubes.

Automatic stations operate continuously and provide hourly and daily data. The automatic stations in 2012 were processed according to the relevant technical standards, with the assistance of project experts from the EC delegation in Tirana. These 2 stations are at the central Polyclinic and PHI and measure values for 8 pollutants: Ozone Nitrogen dioxide, fine particles PM 1, PM 2.5 PM 10, carbon monoxide, sulfur dioxide and benzene.

Diffuse tube stations provide biweekly average data. These are less accurate for monitoring air quality, but are useful for checking more points and identifying hot spots. The tubes were exposed twice, in January and June for two-week periods.

Air quality monitoring in 2012 with diffuse tubes was carried out for 4 pollutants, ozone, nitrogen dioxide, sulfur dioxide and benzene in 10 points: Linza, Kombinat, Kodra e diellit, Kryqëzimi 21 Dhjetori,Stadiumi S. Stermasi, DSHP, Staconi i Trenit, Kryqëzimi Zogu i zi, Klinika Iraniane dhe Kryqëzimi te farmacia 10.. Diffusion tubes are placed close to the traffic.

To characterize the level of air quality, two indices are used, which are:

Air quality health index (AQHI), known in North America (Canada), which is determined by the Equation 1[14].

$$AQHI = 10/10.4x\ (100(e^{(0.000871\ xNO2)} - 1 + e^{(0.000537x\ O3)} - 1 + e^{(0.000487x\ PM)} - 1) \quad (1)$$

Where: NO_2, O_3 and PM are the average concentrations in 3 hours. Units are in PPM (parts per million) and for PM particles in μg/m^3.

As you can see, this is calculated based on the combined action of ozone O_3, nitrogen dioxide NO_2 and PM 10/2.5 particles on the human body. Its value indicates the degree of risk of air pollution, low (1-3), moderate (4-6), high (7-10) and very high (>10). Meanwhile, it is also shown in color on the maps (Figure 1).

Figure 1 Air pollution risk assessment.

The air quality index (AQI) for each pollutant is calculated according to the given guideline [4]. This index is calculated for each air pollutant according to the Equation 2 [23].

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{HI} - BP_{Lo}}(C_p - BP_{Lo}) + I_{Lo} \quad (2)$$

Where:

Ip - index of pollutant, p
Cp - Pollutant concentration, p
BP_{Hi} - Concentration breakpoint greater than or equal to Cp
BP_{Lo} - Concentration breakpoint less than or equal to Cp
I_{Hi} - AQI value corresponding to BP_{Hi}
I_{Lo} - AQI value corresponding to BP_{Lo}

With this method, air quality indices are calculated for 6 pollutants (fine particles PM2.5, PM10, carbon monoxide Nitrogen dioxide, sulfur dioxide and ozone). AQI index values and air quality descriptions are shown in Table 1.

Table 1. Names and colors for all six AQI categories.

AQI values	Description of air quality	Quality color
0 - 50	Good	Green
51-	Moderate	Yellow
100	Unhealthy for sensitive groups	Orange
101-150	Unhealthy	Red
151-200	Very unhealthy	Purple
201-300	Dangerous	Chestnut
301-500		

Currently, data on the level of air pollution in the city of Tirana on the Internet are provided with the AQI index, which takes the value of the largest polluter (Figure 6).

The air quality in an area depends on the weather conditions and the season. Thus, in winter, the air quality is worse than in the summer and spring seasons, because in winter, the pollution discharged from the burning of fuels for heating increases. This pollution generally remains above the city, when it is a valley and when the air at a height of about 80-100 m is warmer than the air at ground level. This causes the formation of a kind of cap, which does not allow the distribution of pollution. These conditions are especially dominant on cold, windless days, often after a cloudless night and when the morning is frosty. Rainfall generally reduces the content of pollutants in the air, especially fine particles.

While in the summer, the sunlight reacts with the pollutants discharged from the cars and this leads to the increase of the ozone content at the level of the earth's surface and as a result of the diseases, that it causes.

3. Health risk assessment from air pollution

The World Bank has estimated that air pollution from vehicles is the main risk for health in world and cause of morbidity and mortality from coronary heart disease, stroke, lung cancer, chronic obstructive pulmonary disease, pneumonia, type 2 diabetes and birth defects.

Air pollution mainly affects the lungs and heart. The most common respiratory diseases are acute respiratory disease (mainly severe coughing), chronic pulmonary disease, heart disease, and lung cancer, which kills most people [2].

Chronic lung disease blocks the flow of air to the lungs and this gets worse over time. As the polluted air passes through the bronchial tube in the throat, it causes inflammation in the alveoli, and stops bringing oxygen to the blood.

Lung cancer occurs when chemicals in the air promote uncontrolled cell growth in lung tissue, preventing them from doing their job. The most common symptoms are coughing (including coughing up blood), weight loss, shortness of breath and chest pain. Preventing cancer means eliminating risk factors, including smoking and air pollution [2,4]. So pollution is the killer that freely enters the human lungs.

Ischemic heart diseases affect the blood supply to the heart, which is the most common cause of death in many countries of the world. Some people are more sensitive to the effects of air pollution than others.

Exposure to air pollution can have acute (quick, strong and short) and chronic (lasting more than 3 months) effects on human health. Some people are more sensitive to the effects of air pollution than others. People with existing heart or lung disease, children and the elderly are particularly susceptible.

According to WHO, deaths related to urban air pollution are [4]:
- 80% of premature deaths are from heart attacks and heart diseases,
- 14% of deaths from chronic obstructive pulmonary diseases or acute pulmonary diseases,
- 6% of deaths from lung cancer.

A new OSCE report, "Economic consequences of air pollution", estimates that by 2060, pollution will cause 6-9 million premature deaths [8].

Meanwhile, the percentages of deaths attributed to air pollution by particles PM2.5 in 2019, according to WHO data by type of disease are given [8]:

13 % Type 2 diabetes
12 % Chronic obstructive pulmonary disease
12% Cancer of the trachea, bronchi and lungs
11% Stroke
10% ischemic heart disease
9% Lower respiratory tract infections
7 % Birth disorders

In Albania, the main factors that cause respiratory diseases are CO_2 (carbon dioxide) and Benzene, which are twice the values approved by WHO [18].

Air Quality Assessments published by the WHO are related to the number of premature deaths, years of life lost and the extent of human diseases associated with exposure to fine particles, ozone and nitrogen dioxide [3].

To characterize the impact of air pollution on human mortality, 2 indicators are used:

Premature deaths (PD) are deaths that occur before a person reaches the expected age. Premature deaths are considered preventable, if their causes can be eliminated

Years of life lost (YLL) are the years of life lost due to premature deaths. It estimates the average number of years people would have lived if they had not died prematurely. Life expectancy rates at the national level are the basic indicators to estimate the years of life lost per 100,000 inhabitants. This indicator is used for comparison between countries.

In order to assess the health risk from air pollution, the WHO in 2013 defined the methodology for calculating the number of premature deaths attributable to exposure to the 3 main pollutants, fine particles PM2.5 , nitrogen dioxide and ozone at a certain degree of pollution [2]. For this, the methodology that shows the correlation between the degree of pollution and mortality has been built.

Also, air pollution affects the growth of many diseases in the human body, which become the reason for the creation of people's incapacity for work. This is a burden that brings personal suffering, but also significant costs for the health care sector. This is determined by the indicator of saliency, which represents the impacts of each pollutant in the increase of diseases that bring about the increase of the degree of disability.

Thus, morbidity expressed in years lived with disability (YLD), due to the impact of the 3 main pollutants, fine particles, nitrogen dioxide and ozone. The WHO for morbidity has defined the methodology for calculating the increase in the number of people with disabilities attributable to exposure to each pollutant at a given pollution level. This indicator is used as years of life with disability per 100,000 inhabitants [2].

The health risks caused by urban air pollution according to the WHO show that [4]:

-80% of premature deaths are from heart attacks and heart diseases,
-14% of deaths from chronic obstructive pulmonary diseases or acute pulmonary diseases,
- 6% of lung cancer deaths

The used methodology has shown that between the ascertained deaths and the calculations of premature deaths there is a match that shows the correlation between pollution and mortality.

There is no evidence to determine a threshold below which air pollution does not affect health. All concentration levels are therefore considered harmful to human health.

The degree of impact of each pollutant on the human body depends not only on the amount of pollutant in the air, but also on the duration of stay in the polluted air. To determine the permissible rate of a pollutant in the air, WHO has relied on studies of the impact of each pollutant, leading to a minimum of premature deaths and years of life lost. So, for PM2.5 particles were analyzed at three factual concentrations: 20, 10 and 0 μg/m3, from which the rate of 5μg/m^3 was set. The same was done for other pollutants. This is the reason that the WHO in 2021 changed the permissible rates by reducing the values compared to 2005 by almost half.

3. Results

From measurements made in 2012 for nitrogen dioxide, there was an excess of the norm of 40 μg/m3 at the points " 21 Dhjetori" with 65.1, at “stacioni trenit” with 52.4, at "Zogu i zi" with 66.4 and at “Farmacia 10” with 49.5 μg /m^3 [14].

In Figure 2 are given the average monthly values of benzene measured at the 2 automatic points for the year 2012 [14].

On the basis of the measured pollution values, the AQHI air quality index calculated for 2012 by PHI in the two automatic centers is shown in Figure 3 [14]. (It seems that hazardous air quality prevails).

Meanwhile, currently the data on the level of air pollution in the city of Tirana on the Internet is given with the AQI index, which takes the value of the biggest polluter (Figure 4).

In Albania, according to the Report of Environment State for 2018, it is underlined that the monitoring of urban air quality with automatic stations was not realized due to non-approval of the devices [15]. Meanwhile, Albania is one of the few countries that does not provide data on pollution parameters in the World Air Quality Index [22].

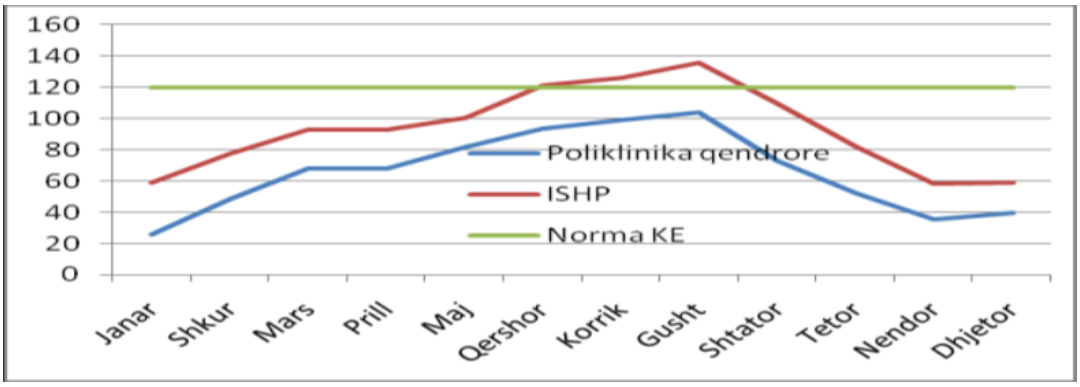

Figure 2 Average benzene levels for 2012 in the city of Tirana (PHI source).

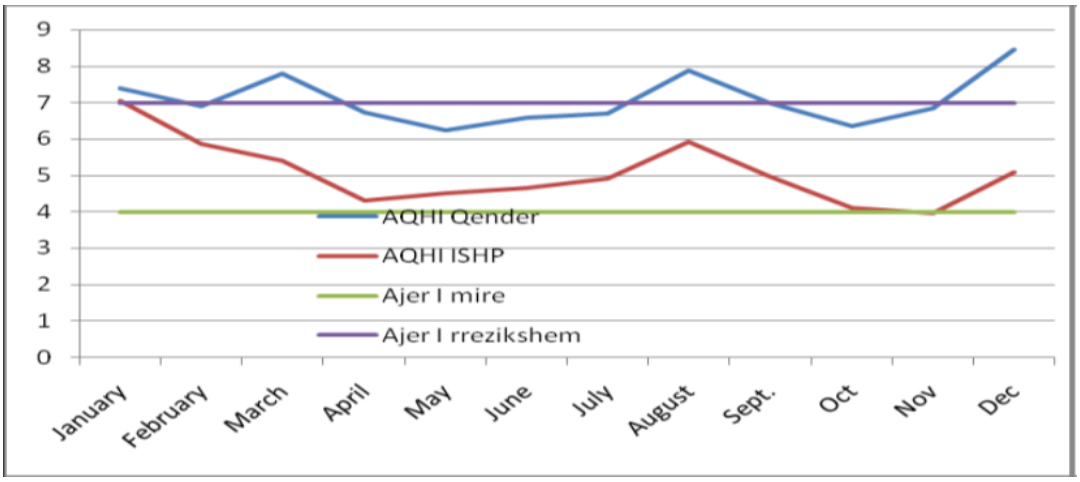

Figure 3 Assessment of the air quality index for 2012 (PHI Source).

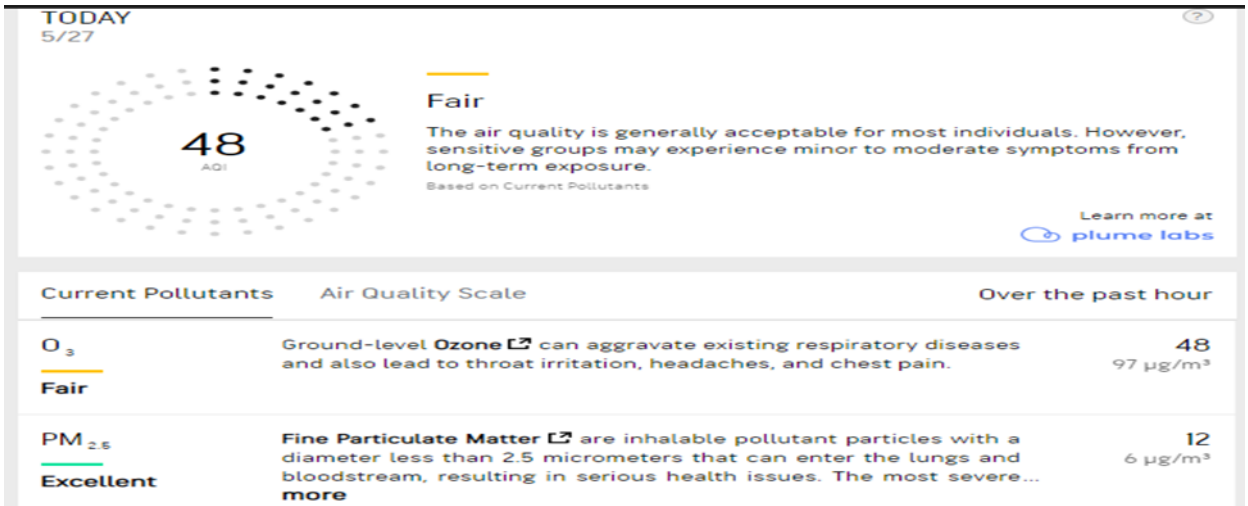

Figure 4. Assessment of the air quality index in Tirana on 27.05.23.

Thus, on the world map, Albania appears simply as a gray area, followed by a note that says: " *There is no* clear information with real data."

Also, an audit of the State High Control comes to the conclusion that "There are inconsistencies between the Annual Environmental Monitoring Programs and the Environment State Reports [17].

Even from the last report of the National Environment Agency published in 2018, where, particles PM10/PM2.5, Nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone and benzene, were monitored in the main cities: Tirana, Elbasan, Durrës, Shkodër, Vlorë and Korça data is given incomplete for some pollutants. For carbon dioxide, no data is given, although it is very dangerous. From the measurements of private stations, it should be noted that the level of carbon dioxide for Albania is several times higher than European standards and this has an impact that has been left unconsidered [12].

Meanwhile, according to the report of the European Environment Agency in 2022 [8], Albania has met only 2 of the 9 objectives required: the level of sulfur in diesel and air quality standards, but not the measurements

Of these, the platform "Green Lungs" project, which is funded by the European Union, currently provides the best data on air pollution [20].

The number of premature deaths in Europe from 2005 to 2020, due to the influence of Ozone above the value of 70 μg/m^3, is increasing (Figure 5) [4].

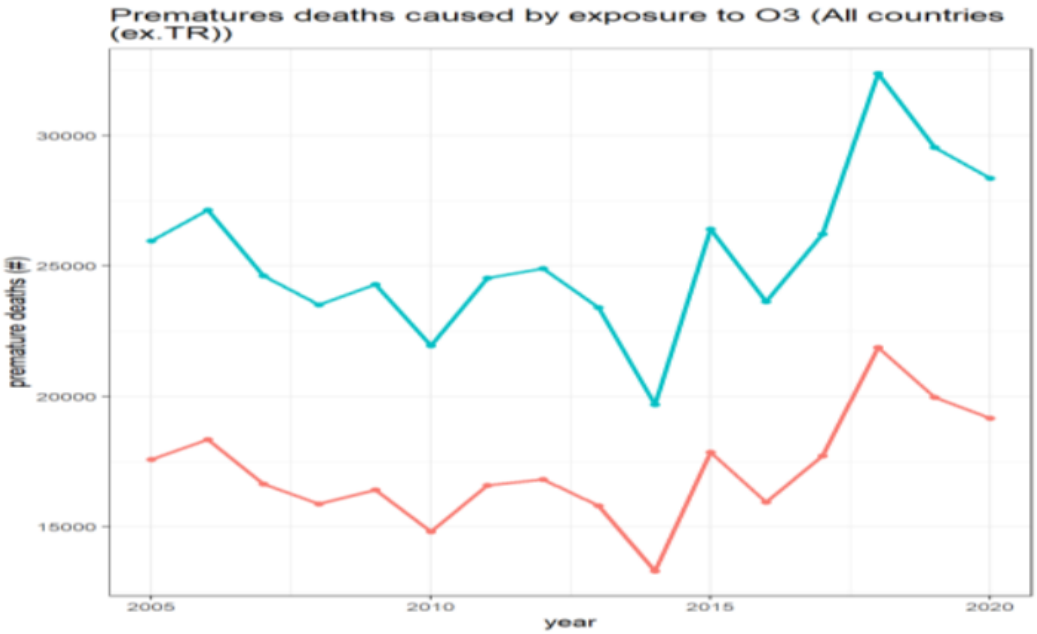

Figure 5. Number of premature deaths in Europe due to the impact of ozone (Source).

The performed assessments show that the greatest relative mortality risk is observed in Central and Eastern Europe for particles PM 2.5, in Central and Southern Europe for nitrogen dioxide and in Southern and Eastern Europe for Ozon. As for the estimates for years of life lost per 100,000 inhabitants, the highest chifres were observed in the countries of Central and Eastern Europe, where the highest concentrations of particles PM 2.5 were also observed.

In Albania, the main factors that cause respiratory diseases are carbon dioxide and benzene, which are twice the values approved by WHO (CO_2 level is 4.05 μg/m^3) [17].

According to the study published by the European Environment Agency, Albania ranks second in terms of deaths caused by environmental pollution, where 23% of deaths in Albania are caused by environmental factors related to air pollution [4].

In Albania, according to data in 2019, 21,937 people lost their lives [13]. While in 2020 in Albania, premature deaths (PD) and years of life lost (YLL) calculated for exposure to concentrations above the norm for the 3 pollutants are given in Table 2 and Table 3 [2].

Table 2. Premature deaths (PD) attributable to exposure to PM 2.5, NO_2 and O_3 in 2020.

PM2.5		NO_2		O_3	
Average annual concentration	Premature deaths	Average annual concentration	Premature deaths	Average annual concentration	Premature deaths
15.6	3,600	12.8	330	5,678	310

Table 3. Years of life lost (YLL) attributable to exposure to PM 2.5, NO_2 and O_3 in 2020.

PM2.5		NO_2		O_3	
Years of live lost (YLL)	YLL/100,000 inhabitants	Years of live lost (YLL)	YLL/100,000 inhabitants	Years of live lost (YLL)	YLL/100,000 inhabitants
36,900	1,296	3,300	116	3,300	115

From the assessments made for 2019, it results that:

- chronic obstructive pulmonary disease, ischemic heart disease, lung cancer, type 2 diabetes (mellitus), strokes and asthma are caused by PM 2.5.
- Asthma (in adults), Diabetes Mellitus and stroke are caused by NO_2.
- Respiratory diseases are caused by O_3

In 2019, morbidity effects for chronic obstructive pulmonary disease in adults aged 25 years and older as a result of exposure to PM2.5 in 30 European countries, were estimated at 175,702 YLD [21]. Air pollution, in addition to being a health problem, worsens the quality of life and hinders economic competition

Thus, the highest rates were seen in Serbia (90 YLD/100,000 inhabitants), Lithuania (85 YLD/100,000 inhabitants) and Croatia (81 YLD/100,000 inhabitants). The lowest rates were seen in Estonia, Finland, Sweden and Iceland. There is no data for Albania.

In Albania, the main factors that cause respiratory diseases are carbon dioxide and Benzene, which are twice the values approved by the WHO in 2021, having one of the highest rates of cancer growth in the region and the number of deaths in 7000 deaths from diseases of heart and 6000 from diabetes type 2 [4].

Pneumologists show that what is damaging the lungs of Albanians are the particles they inhale every day through the polluted air caused by vehicles, old vehicles, dust or smoke that comes from burning waste [21].

4. Discussion

In order to improve the information on the air quality index, it is necessary that the air pollution monitoring stations are kept in good technical condition and validated according to the regulations, to give accurate pollution values. PHI, which is responsible for the health of the population, must take action to provide the air quality index AQI, also measuring and carbon dioxide.

Citizens can learn about air quality through these sources [13]:

1. National Environment Agency (NEA)
2. “Green Lungs” Platform
3. Public Health Institute (PHI)
4. “Tirana ime” application and other applications

In order for people to choose the appropriate place of residence and work according to the type of illness, TV media and portals, when they provide the situation and weather forecast, should also provide information on the degree of environmental pollution in certain areas. So according to the published data, we live in a city that, economically can be promising, but from the health point of view it is highly inadvisable

Thus, from a study conducted in 2017, it is recommended that it should avoid living in some areas in the city of Tirana, in which the level of pollution is high. These areas are: Technological School axis - Astir - Customs, Elbasan Street Crossing, Faculty of Economics Roundabout, Block, Piaca Italia, "21-Dhjetori" Crossing, “Vasil Shanto” Crossing, "Zogu I Zi" Roundabout and “Kombinat” [13].

To improve air quality, it should be taken action to reduce air pollution from vehicles. Thus, the introduction of hybrid and electric vehicles up to 5% reduces pollution by 23% and carbon dioxide by 16% [6]. Meanwhile, the strengthening of control of the technical maintenance of vehicles against pollution criteria, using efficient methods of cleaning the fuel and exhaust system, which reduces pollution up to 2 times, as well as the use of biodiesel fuels, brings a reduction up to 25% and carbon dioxide up to 15% . In this direction, the initiative of the Municipality of Tirana for the introduction of electric buses in urban transport and the creation of facilities for hybrid and electric vehicles is a great help.

Another measure to reduce pollution is the use of biodiesel fuel, from which we benefit from a reduction of pollution by 25% and carbon dioxide by 15%. The use of alternative fuels Fischer-Tropsch**,** E-diesel E15,

ethanol and methanol are also recommended [6].

NEA, which is competent for data on pollution in cities, emphasizes that the air pollution values in Albania for 2020 are mostly above the European Union norm, where high values mainly were particle PM10/PM2.5 and nitrogen dioxide [19].

The "Green Lungs" project provides a great help for pollution measurement, which has installed 5 static devices that perform 24-hour measurements and generate data in real time. Devices are connected, as of October 2020 [20]. From the data of the 3-year project (2018-21), it results that in Tirana the rate of nitrogen dioxide has been exceeded from 40-60 $\mu g/m^3$ to 117 $\mu g/m^3$.

The health effects of air pollution are serious. A third of deaths are caused by stroke, lung cancer and heart disease. High levels of ozone can cause respiratory health problems by reducing lung function, worsening asthma and other lung diseases, and leading to premature death [20].

In Albania, the PIH should work on a model for predicting pollution and health risks for the future, also for the city of Tirana. However, the perfection of the model to predict air pollution and its correlation with health hazards and human activities, especially in urban areas, becomes the greatest demand of the community. This remains the task of ongoing studies aimed at encouraging researchers to develop a new and general framework that can reveal a correlation between the various factors of traffic, weather and air pollution in an area or city.

5. Conclusion

The main pollutants that affect in human health in the city of Tirana are PM 2.5/ PM10 particles, nitrogen dioxide and ozone, which cause the main respiratory diseases up to lung cancer, cardiovascular diseases and high blood pressure. Also dangerous are carbon monoxide, which is deadly, and carbon dioxide, which causes vision impairment, lung congestion, central nervous system damage, muscle contractions, and high blood pressure.

In order to reduce air pollution from vehicles, it is recommended to introduce hybrid and electric vehicles, strengthen the control of technical maintenance of vehicles, using efficient methods of cleaning the fuel and exhaust system, which reduces pollution up to 2 times, as well and the use of biodiesel and alternative fuels

For the city of Tirana, the stations for measuring pollution from PIH, must be kept in a technical state of approval to give accurate values of pollution and with all the elements, and the air quality indicator should be given to the population and international institutions. For this reason, it is recommended that information be provided by TV media and portals, along with the weather forecast for certain areas, so that people can choose the appropriate place of residence and work according to the type of disease. The "Green Lungs" platform gives good results and recommends that living in some areas in the city of Tirana should be avoided

The greatest impact on premature deaths, years of life lost and years of work disability, are particles PM followed by nitrogen dioxide and ozone. For Albania, from exposure to pollution for 2020, we had 3,600 premature deaths from particles PM, 330 from nitrogen dioxide and 310 from ozone. While the lost years of life per 100,000 inhabitants were 1296 from PM particles, 116 from nitrogen dioxide and 315 from ozone.

The health effects of air pollution are serious, with a third of deaths being caused by stroke, lung cancer and heart disease. High ozone levels can cause respiratory health problems by reducing lung function, worsening asthma and other lung diseases, and leading to premature death.

Acknowledgement

This study was partly presented at the 7th Advanced Engineering Days [24].

Funding

This research received no external funding.

Author contributions

Asllan Hajderi: Conceptualization, Methodology, Software, **Ledia Bozo:** Data curation, Writing-Original draft preparation, Validation, Editing.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. EEA Report activity no. 3. Human health and the environment for year 2022. https://www.eionet.europa.eu/etcs/all-etc-reports
2. ETC-HE Report 2022/10 Health Risk Assessment of Air Pollution and the Impact of the Neë WHO Guidelines
3. ETC-HE Report 2023/2 Status report of air quality in Europe for year 2022, using validated and up-to-date data. https://www.eionet.europa.eu/etcs/etc-he
4. https://www.eea.europa.eu/publications/air-quality-in-europe-2022/health-impacts-of-air-pollution
5. Hajderi, A., & Bozo, L. (2014). Air pollution from vehicles and their effect on human health in urban areas. Jurnal Ijesit Edisi, 4(3), 41-47.
6. Hajderi A., & Dulevic A. (2020). The impact of alternative fuel addition on diesel in reducing carbon dioxide and pollution. VI International Scientific Conference of UCB, 69-77
7. Ministry of Environment, (2012). Report for Environment Condition in Albania for year 2011, Tirana 2012. www.qbz.gov.al/botime/fletore_zyrtare/2012/PDF-2012/167-2012.pdf
8. Institute for Health Metrics and Evaluation (IHME), 2020. Global Burden of Disease Study 2019 (GBD 2019) Results
9. Instruction no. 12. (15/06/2010). On some changes in instruction no. 6527, dated 24.12.2004 "On the permissible values of air pollutant elements in the environment from gas and noise emissions caused by road vehicles and their control methods" Official Journal no. 88 date 14.07.2010
10. Law No. 8897 dated 16.5. 2002, On Protection of Air from Pollution, modified by Law No. 10 266, dt. 15.4.2010 For some changes and additions to the law No. 8897

11. Bozo, L., Hajderi, A., & Basholli, F. (2023). The impact of hybrid cars on reducing urban pollution and global warming. Advanced Engineering Days (AED), 6, 117-120.
12. https://portavendore.al/2021/11/15/monitorimi-dhe-minimizimi-i-ndotjes-se-ajrit-sfida-e-qeverise-shqiptare-qe-su-be-asnjehere-realitet/
13. Monitoring report of the Ministry of Tourism and Environment, November 2020-January 2021 https://qeverisja.qq.com.al/index.php/2021/03/01/raport-i-katert-monitorimi-mjedisi-dhe-turizmi/
14. Report of Annual Air Quality for year 2012. ISHP, Tirana (2013).
15. Report on the state of the environment for 2018. http://www.akm.gov.al/assets/raporti-i-gjendjes-ne-mjedis-2018.pdf
16. Report on the state of the environment for 2020. https://ëëë.akm.gov.al/asset/rgjm_2020.pdf
17. Report of the year 2018, KLSH. http://citizens- channel.com/ wp-content/uploads/2018/02/203_vendim_cilesia_e_ajrit_203_date_29_12_2017_3800-1.pdf
18. Report of year 2017 ISHP. http://www.ishp.gov.al/ëp-content/uploads/2015/04/Te-dhenat-e-cilesise-se-ajrit-gazet-nga-st.-autom.- year-2017.pdf
19. Report of "Green Lungs" 2020. https://greenlungs.al/index.php?lng= en%E2%80%99
20. Report of "Green Lungs" 2021. https://albanianpost.com/green-lungs-ndotja-e-tiranes-u-heq-184-dite-jete-qytetareve/
21. Report on the state of the environment for the year 2020. https://ëëë.akm.gov.al/ asset/rgjm_ 2020.pdf
22. The World Air Quality Index (2015). http://aqicn.org/faq/2015-04-28/real-time-air-quality-in-the-balkan-peninsula/?fbclid=IwAR3cbCQTU0OWq5dJafwoPwTv2WBFIkf9mpKG1z84M8rn0HRI0Kdws9QQOG0
23. U.S. Environmental Protection Agency, Technical assistance document for the reporting of daily air quality – the air quality index (aqi), (2020). https://www.airnoë.gov/sites/default/files/2020-05/ aqi-technical-assistance-document-sept2018.pdf
24. Hajderi, A., & Bozo, L. (2023). The air pollution from vehicles and health risks in the city of Tirana. Advanced Engineering Days (AED), 7, 116-119.