Volume 2, Issue 6 June - 2024 **ISSN (E):** 2938-3803

# THE IMPACT OF CLIMATE CHANGE ON AIR POLLUTION IN BAGHDAD AND ITS HEALTH IMPLICATIONS

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**Abstract:**
There are many environmental problems in the city of Baghdad, starting with pollution of air, water, noise, food, public services, water and sanitation facilities, rain drainage, hygiene, waste disposal, and congestion in transportation and communications. In view of the magnitude of these requirements and their insufficiency for the city's population, whose requirements have increased with the increase in their size, the city has been taking rapid measures to meet them. This has led to severe pressure on the components of the natural environment and its central structures, which are no longer able to meet the population's requirements properly, which weakens their resistance to any new variable, especially climate change.

The city of Baghdad is located within the warm section of the tropical region and its climate is desert characterized by continental (interior regions of the continent). Temperatures in the city of Baghdad exceed 30°C in seven months of the year and reach over forty degrees Celsius in the months of July and August. The average annual maximum temperature in the city of Baghdad was 30.3°C. In addition, rainfall varied between the regions of Iraq, especially the city of Baghdad, which falls within the average annual rainfall of 150 mm, which is a small amount, in addition to its fluctuation from year to year. Therefore, relying on it to meet urban needs is not guaranteed.

The city of Baghdad ranks third among the world's most polluted capitals and exports of air pollutants, which portends a very sharp decline in the air quality index, which indicates exceeding the barrier of 150 micrograms/cubic meter for volatile materials PM2.5, and on the Arab Countries level, Iraq occupies the lead in terms of the most polluted Arab Countries, with a rate of 80.1 micrograms per cubic meter, which is 16 times higher, according to the World Health Organization's guide.

The field study showed the reality of the impact of a group of gases and polluting materials on the health of the residents of the city of Baghdad in three monitoring stations, as the highest monthly rate of sulfur dioxide gas (So2) at the Al-Saydiya station in the city of Baghdad for the month of September and in the year 2019 reached (0.046 g/m3), and at a similar rate in the months of August



Web of Humanities: Journal of Social Science and Humanitarian Research

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and October, amounting to (0.043, 0.042) g/m3), and its highest value was in the month of November at Al-Andalus Square station in the center of Baghdad, amounting to (0.062) g/m3. As for Al-Waziriya station, its highest rate was recorded in the month of October, which reached (0.067) g/m3, and its annual rate reached (0.038) g/m3.

The use of energy sources responsible for greenhouse gases has increased in the city of Baghdad, as the general average of total suspended particulates in the city's air reached 633 micrograms per cubic meter in 2016, while the average was about 210 micrograms per cubic meter in 2000, and the highest concentrations recorded during the past periods reached a maximum in 2016, amounting to 8800 micrograms/m3.

All of this was reflected in the general health of the population in terms of an increase in the incidence of diseases, as increasing temperatures above their normal limit through the air containing gaseous pollutants that raise temperatures, such as carbon monoxide and dioxide, nitrogen oxide, sulfur compounds, and hydrocarbons, produces some parasitic diseases that cause skin diseases, such as allergies and skin rashes, in addition to the increase in the growth of harmful insects and their increasing numbers, as well as laziness and lethargy that affect the behavior and the actions of the population, and this in turn increases the susceptibility to the development of psychological diseases and nervous breakdowns, and it has become clear in terms of the spread of diseases affecting children that chicken pox has spread in most of the municipalities of the city of Baghdad. At the municipal level, it appeared that the municipalities of Al-Rusafa, Baghdad Al-Jedida, Al-Ghadeer, Al-Adhamiya, and Al-Sadir City I and II are more affected by various diseases compared to other municipalities, and the reason for this is the high population and housing density in them.

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**Introduction**

The air is considered polluted when its physical and chemical characteristics change or the air carries foreign elements in excess of the normal limit. Air pollutants mainly include carbon dioxide, methane, and nitrogen dioxide. Concentrations of these substances in the air may cause many health and economic problems, and some undesirable aesthetic problems. Human activities that destabilize the Earth's climate itself directly contribute to the release of these gases, in addition to natural factors. The main cause of climate change is the combustion of fossil fuels, which is also a major contributor to urban air pollution.

Changing levels of climate elements have already begun to have a serious impact on human life and health, especially in the city of Baghdad, which has a large population and weak measures taken to limit or resist climate change. This would undermine what has been achieved by decades of progress in the field of health. Therefore, we may not be able to bear the consequences of this change as we move slowly towards controlling climate change, the consequences of which will be serious for health.

The true cost of climate change is being felt in our hospitals and in our lungs, and the health burden of polluting energy sources is so high that the transition to cleaner, more sustainable options for energy supply, transportation, and food systems cannot adequately cover its cost, and when health is taken into account, mitigating the effects of climate change becomes an opportunity that we seize, not a cost that we incur. This was the goal of the research for the purpose of revealing

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mechanisms for resisting this change in order to alleviate the burden on the urban citizen of Baghdad.

The research problem can be formulated with questions as follows:

1- What are the causes of climate change in Iraq and what is its impact on air pollution in the city of Baghdad?

2- To what extent does air pollution affect the health of the residents of Baghdad?

**First) Climate change in the city of Baghdad**

Temperatures in the city of Baghdad exceed 30°C in seven months of the year and reach over forty degrees Celsius in the months of July and August, while temperatures dropped in the remaining five months to less than 25°C, Table (1). The average annual maximum temperature in the city of Baghdad reached 30.3°C, while the annual range reached 32.2°C. The high temperatures in the summer force residents to use large amounts of cooling devices to avoid this rise, which increases the temperature of the atmosphere due to the heat generated by these devices on the one hand and from electrical power generators on the other hand, especially since a large number of them are concentrated within the urban space.

As for the change in the quantity and time of rainfall, the city of Baghdad, although it depends on the Tigris River for its water, the latter depends on its water supply to stabilize its quantity on the rain and the melting of snow over the Turkish regions indirectly, and then the amount of rain has become fluctuating, small, and not sufficient table (2). Some research papers estimated the average amount of rain in Iraq at about 99.865 billion cubic meters annually (United Nations, 2021, p236).

**Table (1) Maximum and minimum temperature rates and the monthly and annual average for Baghdad station for the year 2019**

| Months | January | February | March | April | May | June | July | August | September | October | November | December | Annual rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum temperature | 16.7 | 20.7 | 24.8 | 31.1 | 33.8 | 40.5 | 43.3 | 43.4 | 39.5 | 31.8 | 22.5 | 15.9 | 30.3 |
| Minimum temperature | 6.4 | 9.5 | 11.8 | 16.0 | 20.8 | 24.8 | 26.3 | 24.3 | 20.9 | 13.9 | 13.3 | 5.1 | 16.1 |
| Monthly rate | 11.6 | 15.1 | 18.3 | 23.6 | 27.3 | 32.7 | 34.8 | 33.9 | 30.2 | 22.9 | 17.9 | 10.5 | 23.2 |

Source: Republic of Iraq, Ministry of Transport and Communications, Iraqi Weather Authority, Climate Division, 2019 (unpublished data).

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**Table 2 Rainfall amount (in mm) in the city of Baghdad for the period 2002-2019**

| January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 178 | 137 | 114 | 176 | 27 | 0 | 0 | 0 | 0 | 60 | 124 | 148 |

Source: Iraqi Meteorology Authority, unpublished data for the years 2002-2019.

In light of these numbers, which show the variation in rainfall between the regions of Iraq, the city of Baghdad falls within the annual rainfall rate of 150 mm, which is a small amount, in addition to its fluctuation from year to year. Therefore, relying on it to meet urban needs is not guaranteed, and this fluctuation has serious implications on the urban environment in that it is exposed to the fall of large amounts of rain in a limited time, which led to its complete submergence more than once, the last of which was in 2013 coupled with less provision of drainage, which doubles its impact on the city.

**Second) Sources of air pollution in Baghdad**

Dust in Iraq contains 37 types of minerals that have a serious impact on public health, according to a 2010 report by the Center for War Studies in New York, as well as 147 different types of bacteria and fungi that help spread diseases. The report of the US Environmental Protection Agency in 2011 indicated a high concentration of pollutants in Iraq's atmosphere, such as volatile materials PM2.5, which reached approximately 39.6 micrograms/cubic meter, indicating a significant and dangerous increase in the levels of these pollutants, and at a time when the World Health Organization recommends that average concentrations of PM2.5 should not exceed 5 micrograms/cubic meter, which has led to poor air quality and a high incidence of respiratory diseases. Thus, Iraq occupies the lead in terms of the most polluted Arab Countries, with a rate of 80.1 micrograms per cubic meter and 16 times higher according to the World Health Organization (Steven, 2012, 34).

The sources of air pollution in the city of Baghdad are represented by two main sources: the natural source and the human source. Natural pollutants include dust, bacteria, fungi and their spores, and the most dangerous natural pollutants are those responsible for transmitting communicable diseases through microbes carried in the air in the form of fine particles or fungi stuck in the dust and inhaled when stirred. These microbes enter the human body through breathing, while human source pollutants are anything that would change the composition of the air and are produced by humans, such as industrial pollutants, household waste, garbage, and gases resulting from means of transportation, as well as agriculture and livestock raising.

**A) The human source**

Humans are at the forefront of air pollution in the city of Baghdad after the city's population increased and their use of energy sources responsible for greenhouse gases increased. The general rate of total suspended particulates in the air of the city of Baghdad reached 633 micrograms per cubic meter in 2016, while the rate was about 210 micrograms per cubic meter for the year 2000,





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while the highest concentrations recorded during the past periods reached a maximum in 2016, amounting to 8800 micrograms/$m^3$ during one of the dust storms that occurred in the month of May of the same year and then the same month was repeated with a concentration of 8000 micrograms/$m^3$, Table (3), when comparing the determinants of Table (3) with the data in Table (4) regarding the presence of some similar pollutants in the air of some Countries of the world, it becomes clear that the pollutants of the city of Baghdad can constitute a clear source of health risk.

**Table 3 Types of pollutants in the air of Baghdad in 2016**

| Type of pollutant | Exposure duration/hour | Concentration in micrograms/$m^3$ | Concentration ppm |
|---|---|---|---|
| Nitrogen dioxide | One hour<br>24 hours<br>A year | 390<br>260<br>50 | 0.150<br>0.100<br>0.020 |
| Carbon monoxide | An hour<br>8 hours | 40250<br>10350 | 35<br>9 |
| Photochemical oxidants | An hour | 240 | 0,120 |
| Hydrocarbons other than methane | 3 hours | 160 | 0,240 |
| Total suspended particulates | 24 hours<br>A year | 350<br>150 | -<br>- |
| Lead element | 24 hours<br>A year | 2<br>1.5 | -<br>- |

Source: Ministry of Environment, Environmental Considerations in the Manufacture of Fertilizers and Toxic Substances, Study Series No. 5, Baghdad, Environmental Protection Center, 2019, p. 18.

**Table 4 Determinants of the total suspended particles and nitrogen dioxide in the air during one day in some Countries of the world.**

| Country or city | Micrograms/$m^3$ of suspended particles | Micrograms/$m^3$ of No2 |
|---|---|---|
| United States of America | 150 | 100 |
| Russia | 150 | 85 |
| California | 100 | 95 |
| Japan | 100 | - |
| New York | - | 100 |

Source: Faten Sobhi, Nisreen Mustafa, and Salman Muhammad, a study on the impact of brick factories in Taji on the surrounding environment, Department of Services, Preventive and Environmental Services, unpublished tables 1986, p. 31.

Note that the permissible and proposed limit as a global limit for the presence of solid particulates in the air at 2.5 pm is 10 micrograms/$m^3$ (the average permissible value per year) (25 micrograms/$m^3$ is the average permissible value in twenty-four hours) and at 10 pm, it is (20 micrograms/$m^3$ average permissible value per year) (50 micrograms/$m^3$ average permissible value in twenty-four hours).

As a result, NASA satellite readings of the capital, Baghdad, indicated that it occupies third place among the world's most polluted capitals and exporters of air pollutants, which portends a very

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sharp decline in the air quality index, which indicates exceeding the barrier of 150 micrograms/cubic meter for volatile materials PM2.5 (Preparatory Committee for the United Nations Conference on Housing and Sustainable Urban Development, 2016, Paper 9).

At the forefront of the reasons for the high levels of pollution is the increase in the population of the capital, Baghdad, which reached 5,932,154 people according to estimates in 2019 (Ministry of Planning, 2019, 14), which resulted in increased pressure on the city's infrastructure, as it is not prepared to accommodate such large numbers, in addition to the increase in the number of vehicles, especially those that have not been subject to quality control or a law that guarantees the protection of the environment from vehicle exhaust emissions, which has caused a catastrophic increase in the emissions of suffocating gases and volatile materials, most notably Palyocyclic Aromatic Hydrocarbons, the main cause of many cancerous diseases, especially lung cancer and other diseases, such as strokes and heart attacks.

Waste and garbage, which has increased in size and area greatly in the capital, Baghdad, is the second source of dangerous health pollution, represented by dirt, household garbage, papers, worn rags, pieces of plastic, construction waste, and the proximity of waste dumps to cities. The most important reasons for this are the increase in the population, the decrease in their cultural level, and the increase in the standard of living, which resulted in an increase in the amount of daily consumption. These wastes have become suitable hotbeds for the growth of germs, insects, mice, and other rodents, in addition to the psychological discomfort of the population through the unpleasant odors rising from them and their distortion of the aesthetics of cities and its cultural status (Field Study 2022).

**B) Natural source**

Suspended in the atmospheric air are some fine particles resulting from natural sources, such as particles resulting from wind erosion, sea salts found in coastal areas, and the remains of animal and plant organisms, and fine materials produced in large quantities from forest fires that occur periodically in rural areas, and released in large quantities into the atmosphere, and large quantities of nitrogen oxides (No) produced by lightning strikes, hydrogen sulfide (H2S) released from algae on the surface of the oceans, and methane gas (CH4) that humid environments contribute to its release.

Air pollutants vary in quantity and type and are usually divided into two types:

**1) Primary pollutants**

They are represented by pollutants emitted from the source directly into the outer air, the most significant of which are sulfur oxides, especially sulfur dioxide, which is produced by volcanoes and various industrial processes that include coal and oil, which contain sulfur compounds. When they burn, sulfur dioxide gas is generated, and the process of oxidizing sulfur dioxide gas usually takes place in the presence of a catalyst such as nitrogen dioxide. The oxidation process produces sulfuric acid, acid rain, and nitrogen oxides, especially nitrogen dioxide, which is one of the most important pollutants in the air. It is found in the form of a foggy dome over cities, as it is emitted from combustion processes that occur at high temperatures. This toxic reddish-brown gas is characterized by a sharp smell, and carbon monoxide, which is a colorless and odorless gas, but is very toxic, and is produced by incomplete combustion of fuel, such as: natural gas, coal, or wood, and vehicle exhausts are the main source of carbon monoxide. Carbon dioxide is one of the

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most significant greenhouse gases emitted from the combustion process.

As for fine objects, they are solid or liquid particles suspended in gas, with a diameter ranging between 2.5-10 mm. They may be created by nature through volcanoes, sand storms, forest or grass fires, and sea spray, or they may be created by humans through the combustion of fossil fuels, power plants, and insulating materials. These particles affect the human lungs, where they accumulate inside them and affect the process of gas exchange.

**2) Secondary pollutants**

These pollutants are formed when primary pollutants interact in the atmosphere. Examples include particles formed from primary gaseous pollutants and compounds found in photochemical smog. Regular smog consists of a mixture of sulfur dioxide and fog resulting from burning coal. Modern smog results from compounds and industrial emissions that react in the atmosphere with sunlight to form secondary pollutants, and when they combine with primary pollutants, photochemical smog is formed.

The so-called ground-level ozone layer is formed from nitrogen oxides and volatile organic compounds. Ozone is the main component of the troposphere, and it is also an important component of the stratosphere, known as the ozone layer. Chemical reactions, and the photochemical reactions that accompany them, drive many of the chemical processes that occur in the atmosphere during the day and night (Al-Dazii, 2022, 57).

**3) The applied aspect of air pollution in the city of Baghdad**

Air pollution is considered one of the major environmental risks to health, and by reducing air pollution levels, Countries can reduce the burden of diseases resulting from strokes, heart disease, lung cancer, and chronic and acute respiratory diseases, including asthma. As air pollution levels decrease, the cardiovascular and respiratory health of the population improves, in the long and short term.

The problem of air pollution arose as a result of human technological, industrial and cultural progress. In 2019, 99 percent of the world's population lived in places that did not meet the levels specified in the guidelines issued by the World Health Organization on air quality. Every day, thousands of chimneys release tons of gases that spoil the air and make it harmful to breathing. Sulfur dioxide gas (SO2) causes inflammation and constriction of the airways, emphysema, and asthma. Ambient air pollution (outdoor air) in both cities and rural areas is estimated to have caused about 4.2 million premature deaths globally in 2016, with about 91 percent of these premature deaths occurring in low- and middle-income Countries. The largest number of them were concentrated in the organization's regions of Southeast Asia and the Western Pacific, and policies and investments supporting the establishment of cleaner means of transportation, achieving energy efficiency in homes and the electric power generation and industry sectors, and improving waste management in municipalities would reduce the main sources of outdoor air pollution. More than half of the monitored cities in high-income Countries and more than a third of those cities in low- and middle-income Countries have succeeded in reducing air pollution levels by more than 5% in five years (Jassim, 2017, 121).

Data from the Iraqi Ministry of Health revealed the true impact of a group of gases and air pollutants on the health of residents of the city of Baghdad in three monitoring stations, as it

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appeared in Table (5) that the highest monthly rate of sulfur dioxide gas (So2) at Al-Saydiya station in the city of Baghdad for the month of September reached (0.046 g/m$^3$), and a similar rate in the months of August and October, amounting to (0.043 and 0.042 g/m$^3$), and its highest value was in the month of November at Al-Andalus Square station in the center of Baghdad, amounting to (0.062 g/m$^3$). See Table (6), as for Al-Waziriya station, its highest rate was recorded in the month of October, which amounted to (0.067 g/m$^3$), and its annual rate reached (0.038 g/m$^3$) as shown in Table (7).

As for nitrogen dioxide gas (NO2), it is produced by the combustion of organic compounds and the exhausts of cars, trucks, and power generation plants. This gas can cause scratching of the lungs and reduce internal immunity when the respiratory system is infected, shortness of breath, and pain in the head, especially in people with asthma and bronchitis.

**Table (5) Monthly and annual rates for a group of gases and pollutants measured in the city of Baghdad (Al-Saydiya station) for the year 2019**

| The month | So2 | N0 | N02 | N0x | Co | CH4 | Suspended particulates Pm (2.5) |
|---|---|---|---|---|---|---|---|
| | PPM | PPM | PPM | PPM | PPM | PPM | Ug/ m$^3$ |
| January | 0.024 | 00.037 | 0.025 | 0.062 | 0.493 | 1.943 | 00 |
| February | 0.018 | 0.030 | 0.026 | 0.055 | 0.427 | 1.965 | 17 |
| March | 0.011 | 0.009 | 0.016 | 0.026 | 0.275 | 2.013 | 17 |
| April | 0.016 | 0.008 | 0.015 | 0.023 | 0.254 | 1.880 | 22 |
| May | 0.035 | 0.027 | 0.033 | 0.060 | 0.362 | 1.904 | 57 |
| June | 0.035 | 0.022 | 0.039 | 0.061 | 0.349 | 1.944 | 36 |
| July | 0.024 | 0.026 | 0.035 | 0.061 | 0.299 | 1.817 | 33 |
| August | 0.043 | 0.040 | 0.048 | 0.088 | 0.464 | 1.938 | 52 |
| September | 0.046 | 0.035 | 0.043 | 0.078 | 0.429 | 1.896 | 50 |
| October | 0.042 | 0.019 | 0.030 | 0.078 | 0.451 | 1.957 | 52 |
| November | 00 | 0.017 | 0.032 | 0.048 | 0.490 | 2.055 | 65 |
| December | 0.026 | 0.049 | 0.027 | 0.076 | 0.551 | 2.069 | 64 |
| Annual rate | 0.029 | 0.027 | 0.031 | 0.057 | 0.404 | 1.948 | 42 |

Source: Ministry of Health and Environment, Environmental Sector, Department of Planning and Follow-up, unpublished data for the year 2019.

**Table (6) Monthly and annual rates for a group of gases and pollutants measured in the city of Baghdad (Andalus Square Station) for the year 2019**

| The month | So2 | N0 | N02 | N0x | Co | CH4 | Suspended particulates Pm (2.5) |
|---|---|---|---|---|---|---|---|
| | PPM | PPM | PPM | PPM | PPM | PPM | Ug/ m$^3$ |
| January | 0.034 | 0.046 | 0.120 | 0.058 | 0.459 | 00 | 00 |
| February | 0.027 | 0.056 | 0.016 | 0.072 | 0.498 | 00 | 94 |
| March | 0.023 | 0.008 | 0.012 | 0.020 | 0.269 | 00 | 25 |
| April | 0.021 | 0.006 | 0.06 | 0.009 | 0.245 | 1.912 | 24 |
| May | 0.030 | 0.010 | 0.015 | 0.025 | 0.383 | 1.987 | 43 |
| June | 0.035 | 0.014 | 0.019 | 0.032 | 0.354 | 1.895 | 34 |
| July | 0.036 | 0.018 | 0.016 | 0.034 | 0.360 | 1.752 | 31 |
| August | 0.035 | 0.026 | 0.018 | 0.044 | 0.398 | 1.819 | 39 |
| September | 0.042 | 0.021 | 0.026 | 0.047 | 0.443 | 1.959 | 43 |
| October | 0.052 | 0.020 | 0.032 | 0.049 | 0.553 | 2.058 | 59 |
| November | 0.062 | 0.069 | 0.022 | 0.090 | 1.105 | 1.737 | 85 |
| December | 0.053 | 0.071 | 0.011 | 0.082 | 0.689 | 00 | 83 |
| Annual rate | 0.038 | 0.030 | 0.017 | 0.047 | 0.480 | 1.890 | 51 |

Source: Ministry of Health and Environment, Environmental Sector, Department of Planning and Follow-up, unpublished data for the year 2019.





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Carbon monoxide (CO) is one of the most dangerous gases to human health because an increase in it causes blockage of blood vessels, causing death (Bayah, 2008, 59). It represents the largest percentage of air pollutants, and is produced from the incomplete combustion of fuel and organic materials.

**Table (7) Monthly and annual rates for a group of gases and pollutants measured in the city of Baghdad (Al-Waziriya Station) for the year 2019**

| The month | So2 | N02 | Co | CH4 | Suspended particulates Pm (2.5) |
|---|---|---|---|---|---|
| | PPM | PPM | PPM | PPM | Ug/ $m^3$ |
| January | 0.038 | 00 | 1.214 | 1.758 | 00 |
| February | 0.020 | 0.032 | 0.885 | 1.731 | 46 |
| March | 0.027 | 0.020 | 0.710 | 1.769 | 33 |
| April | 0.020 | 0.019 | 0.632 | 1.798 | 25 |
| May | 0.025 | 200.0 | 0.643 | 1.851 | 28 |
| June | 0.032 | 0.026 | 0.574 | 1.833 | 41 |
| July | 0.036 | 0.028 | 0.521 | 1.855 | 31 |
| August | 0.034 | 0.033 | 0.561 | 1.854 | 39 |
| September | 0.038 | 0.034 | 0.649 | 1.866 | 42 |
| October | 0.067 | 0.045 | 0.908 | 1.890 | 67 |
| November | 0.061 | 0.050 | 1.357 | 1.982 | 79 |
| December | 0.058 | 0.048 | 1.266 | 1.896 | 72 |
| Annual rate | 0.038 | 0.032 | 0.827 | 1.840 | 46 |

Source: Ministry of Health and Environment, Environmental Sector, Department of Planning and Follow-up, unpublished data for the year 2019.

Suspended materials, microorganisms or microbes, fungi and various bacteria spread in the air, which is a mixture of solid particles and vapors and causes lung cancer, because these particles are able to penetrate the lung passages and enter the bloodstream, causing damage to the heart and blood vessels and causing damage to the respiratory system. It can cause mild to severe diseases (such as wheezing, coughing, dry mouth, bronchitis, chronic obstructive pulmonary disease, and other damage to the respiratory system). Temperature change is a major and influential factor in the continuity of life for living organisms, including humans. On the other hand, temperature stability is an important factor for maintaining environmental balance and a major reason for the continuation of life for various living organisms, as temperatures increase beyond their natural limit through the air containing gaseous pollutants that raise temperatures, such as carbon monoxide and dioxide, nitrogen oxide, sulfur compounds, and hydrocarbon materials. It produces some parasitic diseases that cause skin diseases, such as allergies and rashes, as well as an increase in the growth of harmful insects and an increase in their numbers, as well as laziness and lethargy that affect the behavior and actions of the population, and this in turn increases the susceptibility to the development of psychological diseases and nervous breakdowns. These diseases affect city residents during periods when temperatures exceed 40°C. It must be noted that the average temperature of July in the city of Baghdad ranges between 34-36°C, and the average temperature of the coldest month in January reached 9°C (Rabie and Jassim 2021: 47).





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The temperature change between summer and winter in cities results in many diseases, including influenza and colds, and the effects of wind speed and direction lie in the dust storms that affect the city of Baghdad, especially in the summer, which sometimes lasts for several consecutive days with repeated occurrences, and its impact is exhausting for those suffering from chest diseases and asthma, and a source of great inconvenience for those suffering from psychological illnesses, in addition to its economic effects.

The chemical characteristics of the air are almost constant, except for some changes caused by pollution, represented by ammonia gases, nitrogen oxide, sulfur, some vapors, coal atoms, and microbes. This is because there are many factories that produce such gases, and an increase or decrease in their percentage in the air affects public health, as 1-17 of deaths and 1-24 of disability cases in Hungary are due to air pollution directly and indirectly. Industrial pollution in the Silesian region in the southern Netherlands also threatens the health of 2.5 million people (Rabie, 2013: 94). If the percentage of charcoal increases to 1%, it leads to shortness of breath, but if the percentage of ozone increases above one per million of air, it leads to scratching of the respiratory mucous membranes.

**Fourth) The impact of air pollution on the health of residents of the city of Baghdad**

The residents of the city of Baghdad, especially poor families, face many diseases that vary according to the environment and the level of air pollution (Table 8), in addition to the difference in the body's resistance to diseases, as diseases spread in all areas of the city of Baghdad, but in varying proportions. The field study focused on children's infections for the following considerations:

1- The fact that children are considered one of the weak groups in terms of resistance to diseases compared to other age groups.

2- Baghdad Health Department, Epidemiological Monitoring Department was relied upon in terms of obtaining data.

**Table (8) Changes in air composition and qualities during breathing**

| Gases | Percentage in air % | Exhaled air % |
|---|---|---|
| Oxygen | 21 | 15.5-8 |
| Coal gas | 3-4 | 2.5-5 |
| Water vapor | Different proportions | saturated |
| temperature | Different | 350-370 |

Source: Man and the Environment, the Arab Organization for Education, Culture and Science, a reference in environmental sciences for higher and university education, the Arab Organization Press, Cairo, 1978, p. 455.

In terms of the spread of diseases, it appeared that chickenpox spread in most of the municipalities of the city of Baghdad, except for the municipalities of Al-Mansour and Al-Shuala. See Table (9) and shown in Map (1). At the municipal level, it appeared that the municipalities of Al-Rusafa, Baghdad Al-Jedida, Al-Ghadir, Al-Adhamiya, and Al-Sadir City I and II are more affected by various diseases compared to other municipalities. The reason for this is the high population and housing density in them, as shown in Table (10). See Maps 2 and 3.

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In addition to population density, the low standard of living in these municipalities is another influential factor in increasing the infection rate. In other words, overpopulation, high population density, and low standard of living play a major role in the spread of diseases.

Although all groups are infected with diseases, there is a difference between them. Whooping cough came first in terms of infection in age groups less than one year, with a rate of 84.6%, and those from 1-4 years, with a rate of 34.3%. Table 11, while hepatitis A ranked first for the group (5-14) with a rate of 48%, the least affected disease is mumps, and the age group (1-4) was free of infection with this disease.

In a live meeting with doctors in the Medical City in Baghdad, most of them explained that the majority of the causes of infection are air pollution, and its danger increases in confined spaces and high population density. In this regard, a World Health Organization report issued in October 2018 stated that 93 percent of the world's children breathe toxic air every day, and according to the report, 1.8 billion children breathe highly polluted air, putting their health and development at serious risk. The World Health Organization estimates that in 2016, nearly 600,000 children died from acute lower respiratory infections caused by air pollution, and that more than 40% of the world's population - including one billion children under the age of 15 who are exposed to high levels of household air pollution mainly through cooking with polluting technologies and fuels. In developing countries, women often rely on charcoal and biomass fuels for cooking and heating, which increases the possibility of them and their children being exposed to the risk of the effects of household pollutants. (Optimum Scientific Series, 2007, 81).

**Table 9 Growth rate of children's disease cases according to municipal units in the city of Baghdad for the period 2014-2019**

| municipality | Diseases | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Chicken pox | Viral hepatitis A | Serum hepatitis B | Mumps | Pneumonia | Measles | Typhoid | Whooping cough | Overall growth rate |
| Al-Karkh | 1343 | 67 | 51 | 13 | 41 | 7 | 5 | 21 | 1.011 |
| Al-Kadhimiya | 1581 | 77 | 54 | 21 | 50 | 54 | 22 | 42 | 1.022 |
| Al-Mansour | 21 | 81 | 43 | 19 | 31 | 4 | 2 | 4 | 0.971 |
| Al-Shula | 24 | 15 | 36 | 12 | 14 | 2 | 9 | 3 | 1.001 |
| Al-Dora | 988 | 44 | 56 | 42 | 24 | 3 | 12 | 20 | 1.001 |
| Al-Rasheed | 1578 | 32 | 76 | 61 | 17 | 21 | 13 | 57 | 1.134 |
| Al-Rusafa | 548 | 289 | 149 | 229 | 1499 | 41 | 0 | 3 | 1.054 |
| Al-Karrada | 123 | 2 | 0 | 9 | 7 | 3 | 3 | 0 | 1.833 |
| Baghdad | 559 | 152 | 18 | 383 | 135 | 63 | 8 | 8 | 1.055 |
| Al-Ghadeer | 1129 | 197 | 37 | 2538 | 306 | 112 | 21 | 12 | 1.053 |
| Al-Adhamiya | 590 | 162 | 38 | 49 | 152 | 25 | 8 | 0 | 1.001 |
| Al-Shaab | 2420 | 152 | 37 | 805 | 43 | 64 | 21 | 4 | 1.123 |
| Al-Sadir 1 | 2000 | 327 | 30 | 1200 | 1000 | 75 | 20 | 5 | 1.275 |
| Al-Sadir 2 | 581 | 200 | 15 | 788 | 796 | 42 | 6 | 2 | 1.106 |
| Total | 13485 | 1797 | 640 | 6158 | 4115 | 516 | 150 | 181 | |

Source: Ministry of Health, Baghdad Health Department (Karkh and Rusafa), Epidemiological Monitoring Department, unpublished tabulated data, 2019.

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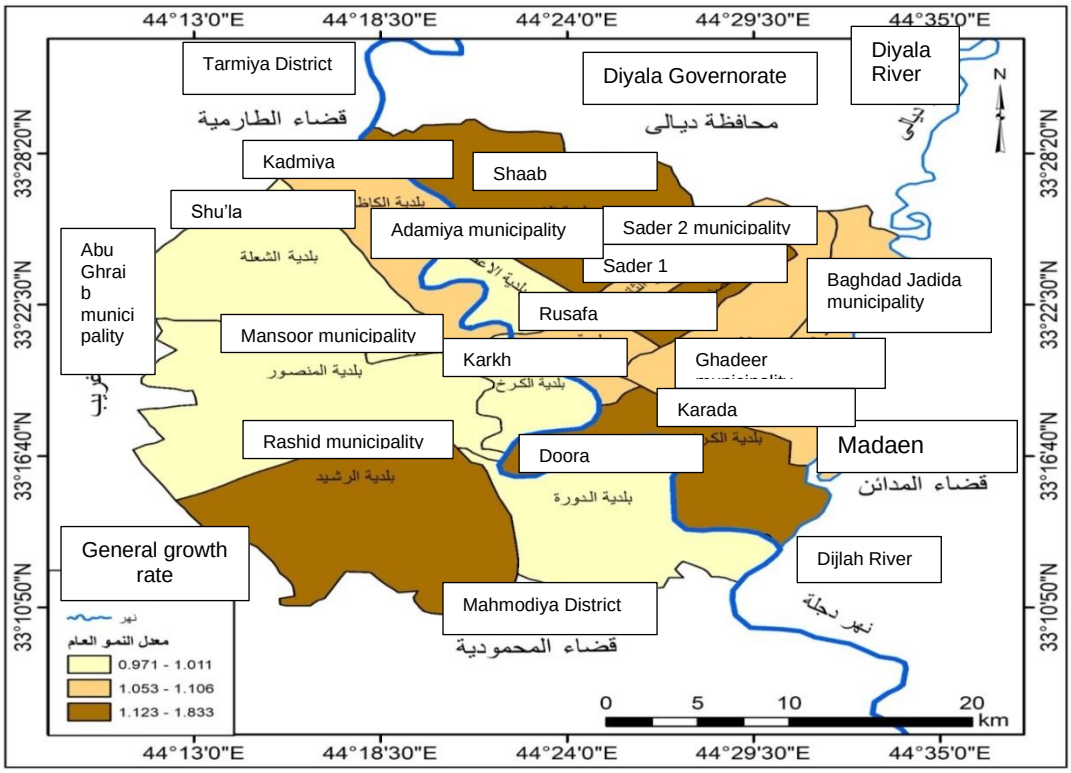


**Map 1 Growth rate of diseases in the city of Baghdad at the municipal level for the year 2019**

Weather phenomena in Iraq, such as floods and heat waves, are increasing in frequency and intensity, especially by changing the properties of the air. They threaten the lives of children and destroy infrastructure vital to their well-being. Floods also weaken water and sanitation facilities, as happened in the city of Baghdad in 2014, which has led to the spread of diseases such as cholera, which represents an imminent danger to children in particular, as approximately 785 million children lack access to basic water services, and by 2040, it is expected that 600 million children will live in areas where the demand for water exceeds the amount of available resources (United Nations, 2021, p233.).

**Table 10 Population density of the city of Baghdad at the municipal level for the year 2019**

| Serial No. | Municipality name | Area/km2 | Population 2016 | Population density | Number of families |
|---|---|---|---|---|---|
| 1 | Al-Rasheed | 135.84 | 762018 | 5.64 | 134404 |
| 2 | Al-Mansour | 127.12 | 347303 | 2.73 | 87461 |
| 3 | Al-Shula | 89.09 | 486640 | 5.46 | 97328 |
| 4 | Al-Dora | 85.64 | 321180 | 3.77 | 64236 |
| 5 | Al-Karrada | 72.47 | 318828 | 4.42 | 63766 |
| 6 | Al-Shaab | 85.17 | 621935 | 7.31 | 124387 |
| 7 | Al-Adhamiya | 29.53 | 335753 | 11.57 | 57637 |
| 8 | Al-Sadir 1 | 22.15 | 484234 | 22.01 | 137400 |
| 9 | Al-Sadir 2 | 20.89 | 686998 | 34.34 | 96847 |
| 10 | Al-Rusafa | 25.47 | 212789 | 8.51 | 42558 |

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| | | | | | |
|---|---|---|---|---|---|
| 11 | Al-Ghadeer | 49.92 | 437389 | 8.92 | 87478 |
| 12 | Baghdad Al-Jedida | 67.62 | 637666 | 9.51 | 127533 |
| 13 | Al-Karkh | 23.81 | 114250 | 4.96 | 22850 |
| 14 | Al-Kadhimiya | 50.80 | 165171 | 3.30 | 33034 |
| | Total | 885.52 | 5932154 | 6.70 | 1176919 |

Source: Ministry of Planning, Central Bureau of Statistics and Information Technology, unpublished data, inventory and numbering 2019. Source: Ministry of Planning, Central Bureau of Statistics and Information Technology, unpublished data, inventory and numbering 2019.

**Fourth) Methods of treating air pollution in cities**

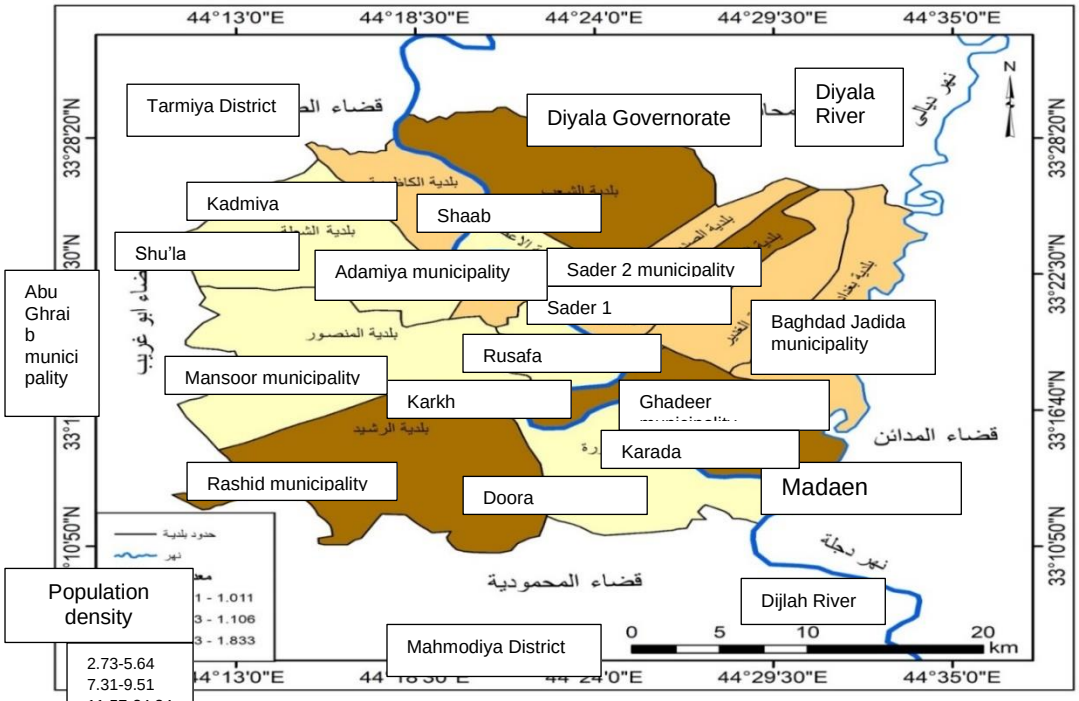
In order for city administration to succeed in developing a comprehensive plan in the city that takes it upon itself to reduce pollutants in it, the following must be followed (Al-Jalili et al., 2002, 78):

1) Establish specific environmental considerations for the proposed industrial sites, taking into account the site's topography, weather conditions, population density, and the economic feasibility of each industrial project.

2) Isolating all types of industries in a unified location on one of the outskirts of the city or outside the city limits.

3) Emphasizing the establishment of green belts surrounding cities as an absolute necessity.

4) Use an index to measure air quality using the Air Quality Index, which works like a thermometer and extends from 0-500 degrees; This index shows changes in the amount of air pollution. If it is less than 50 degrees, for example, this indicates that the air quality is good, and the person can spend some time outdoors, and air pollution will not pose any risks to his health. The higher the index, the greater the risks to health.




Map 2 General population density (by municipalities) in the city of Baghdad for the year 2019

Source: Based on data from Table 10

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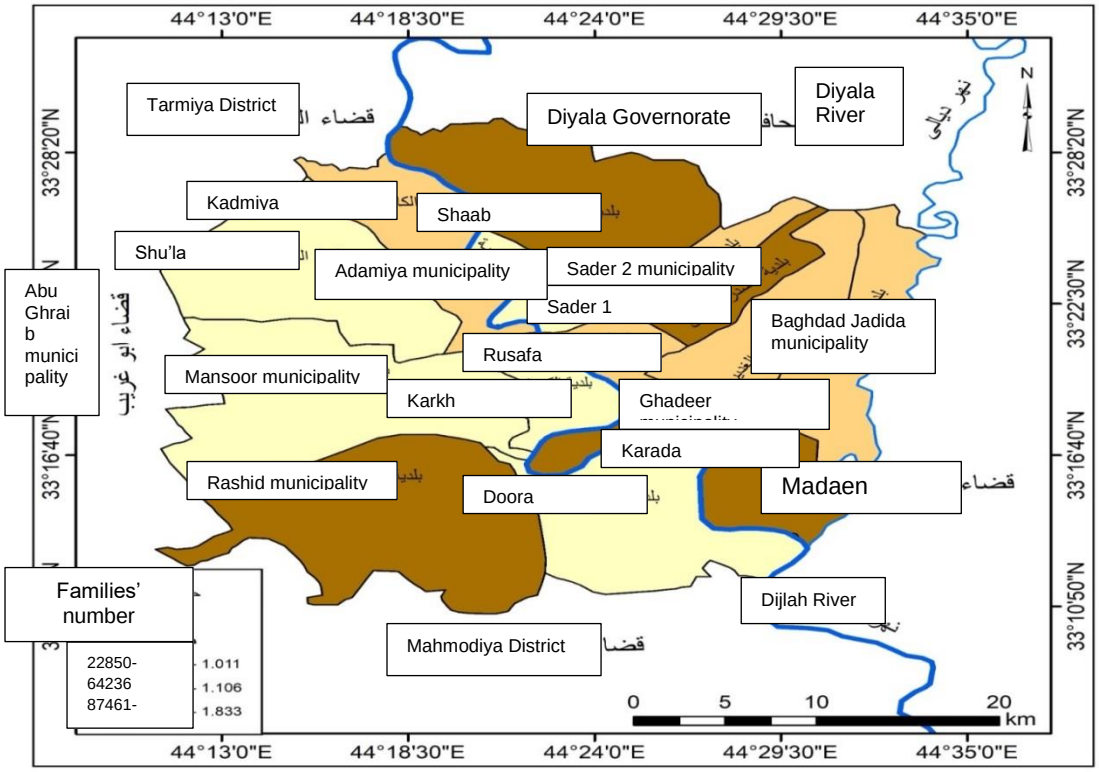


**Map 3 Residential density of families/km2 (according to municipalities) in the city of Baghdad**

Source: Based on data from Table 10

**Table 11 Disease incidence among children by age groups in the city of Baghdad in 2019**

| Diseases / Municipality | less than one year | The ratio % | 1-4 | The ratio % | 5-14 | The ratio % | Total | The ratio % |
|---|---|---|---|---|---|---|---|---|
| Chicken pox | 132 | 4.3 | 14 | 0.5 | 8 | 1.5 | 154 | 0.7 |
| Hepatitis | 113 | 3.8 | 314 | 11.2 | 7358 | 48.0 | 7785 | 36.8 |
| Serum hepatitis | 177 | 5.1 | 824 | 29.3 | 5852 | 38.1 | 6853 | 32.3 |
| Mumps | 4 | 0.1 | 0 | 0 | 8 | 1.5 | 12 | 0.05 |
| Pneumonia | 6 | 0.2 | 452 | 16.1 | 1042 | 6.8 | 1500 | 12.3 |
| Measles | 2 | 0.07 | 9 | 0.3 | 16 | 0.10 | 27 | 0.13 |
| Typhoid | 36 | 1.2 | 234 | 8.3 | 744 | 4.9 | 1014 | 8.3 |
| Whooping cough | 2576 | 84.6 | 964 | 34.3 | 300 | 2.0 | 3840 | 18.1 |
| Total | 3046 | 100 | 2811 | 100 | 15328 | 100 | 21185 | 100 |

Source: Ministry of Health, Baghdad Health Department, Epidemiological Monitoring Department, unpublished tabulated data for the years 2014-2019.

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**References**

1- Man and the Environment, Arab Organization for Education, Culture and Science, a reference in environmental sciences for higher and university education, Arab Organization Press, Cairo, 1978.

2- Baya, Bozghaia, Environmental Pollution and Development in the City of Biskra, Master's Thesis (unpublished), Matnouri University of Constantia, Faculty of Humanities and Social Sciences, 2008.

3- Jassim, Qadisiya Hussein, Spatial variation in children's diseases in the city of Baghdad, Al-Rusafa, unpublished master's thesis, Mustansiriya University, Baghdad, 2017.

4- Al-Dazii, Salar Ali Khadr, Concepts of the Gasosphere, Meteorology, Weather, and Climate - Past and Present, Baghdad, Dar Al-Adab, 2022.

5- Field study for the year 2022 on the waste dump and monitoring the damage resulting from it in terms of its discomfort to the population and the environment.

6- Rabie, Muhammad Saleh and Jassim, Qadisiya Hussein, the impact of air pollution on the spread of respiratory diseases in the first and second municipalities of Al-Sadr, Uruk Journal for the Human Sciences, No. 698, 2021.

7- Rabie, Muhammad Saleh, Radioactive pollution in Iraq and its environmental repercussions, Proceedings of the twentieth College of Education Conference for the period 24-25 April 2013, Volume One, 2013.

8-The Optimum Scientific Series, the phenomenon of global warming, the rise in the temperature of the planet and the accompanying climate changes, Lebanon, Lebanon Publishers Library, 2007.

9- Al-Kaabi, Ali Abdulhassan Ibrahim, Characteristics of the tropospheric level and its relationship to some weather phenomena over the central region of Iraq, unpublished doctoral thesis, Mustansiriya University, 2019.

10- Noman Al-Jalili, et al, an econometric analysis of the relationship of economic development to the increase in urban population, research presented at the Fifth Iraqi Geographical Conference, October 2002, p. 34.

11- Ministry of Planning, Central Bureau of Statistics, Population Estimates for the year 2019, Baghdad Municipality, unpublished data, pamphlet 7.

12-Ministry of the Environment, Environmental Considerations in the Manufacture of Fertilizers and Toxic Substances, Study Series No. 5, Baghdad, Environmental Protection Center, 2019.

13- Chu, Steven, and Arun Majumdar (2012). Opportunities and challenges for a sustainable energy future. Nature, 488, (August), pp. 294-303

14- Preparatory Committee for the United Nations Conference on Housing and Sustainable Urban Development, 2016: 61/3.) Preparatory Committee for the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) Third Session Surabaya, Indonesia, 25-27 July 2016 Policy Paper 9: Urban Services and Technology.

15- United Nations, Human Rights, How Climate Change Affects the Human Rights of Migrants in the Sahel, 11 November 2021.

16- (https://mawdoo3.com,2021/)