ACE PUBLICATIONS
www.theacepublications.com

ACE JOURNAL OF ENVIRONMENTAL SCIENCES

Research Article

A Study of the Impact of Environmental Pollution Resulting from Electric Generators in the Al-Ghazaliya Neighborhood, Block 681

Ali Saadoon Ahmed
Institute of laser for postgraduate studies, University of Baghdad, Baghdad, Iraq

KEY WORDS:
Pollution
Gazelle
Environment
Generators

Abstract: The severe shortage of national electricity and the urgent need for electricity have led to the widespread use of electric power generators, especially in residential areas, in a random and irregular manner, which has led to an increase in the percentage of pollutants in the residential environment, the most important of which is air pollution resulting from the emission of large quantities of gases such as carbon monoxide and noise pollution resulting from the sound of engines exceeding the permissible limit (de sable 25), and from here the research study began to monitor the negative environmental effects represented by air and noise pollution resulting from electric generators and their negative effects on the residential environment, relying on the scientific deductive approach that includes a field survey and field air pollution measuring devices based on mathematical models that clarify the distance in which air and noise pollution spreads., Determine the locations of generators, the number of generators at each location, their operating period, the type of pollutants, and their effects on human health.

Corresponding Author:
Ali Saadoon Ahmed ,
Institute of laser for postgraduate studies, University of Baghdad, Baghdad, Iraq

INTRODUCTION

Perhaps the severe shortage of electrical power supplies in Iraq in general has led citizens to resort to compensatory energy represented by diesel generators, which are randomly spread in the neighborhoods of Baghdad. Diesel generators have provided solutions to compensate for the shortage in electrical power supply from the national grid, However, it has directly contributed to the pollution of residential areas, as it has led to air pollution from exhaust fumes emitted by generators and the formation of smoke clouds laden with carbon and toxic gases. In addition to polluting the environment surrounding the generators due to the floods of oil and cooling water and the loud noise caused by the high sounds of the generator engines, especially in the homes near them, this pollution has become a threat to the health of citizens, This necessitated conducting such a study to determine the concentration of waste from these generators and to determine the appropriate distance to the generator site to reduce pollution in all its forms in line with the standards set by the Iraqi state. This is what this study aims to achieve.

There are several studies that have addressed the problem of pollution in general and demonstrated its impact on the environment, including the study by Yusra Badri Nour Al-Husseini .

The impact of pollution by suspended materials and its impact on the environment. A study by Shukri Ibrahim Al-Hassan: Evaluation of the problem of noise pollution and its health effects in some Basra schools. A study by Sahar Saeed Al-Taie and Ali Zoran Ali A study of the impact of noise pollution from private generators on the right side of Mosul city using geographic information systems. A study by Ali bin Ahmed bin Ali Al-Hamid: Noise pollution, its effects, measurement and methods of mitigation. A study by Heba Shalabi: Atmospheric air pollution by gases. A study by Salah Mahdi Ali Zini: Air pollution within industrial facilities in Baghdad. Saadia Abdul-Kazem Al-Zuhairi's study: Air pollution in Sadr City. Abdul-Rahman Sabry Marwan *et al*. study: Noise pollution levels in the city and their resulting effects. Shukri Ibrahim Hassan's study: Environmental pollution in Basra. Each of the aforementioned studies was distinguished by the fact that it addressed the problem of environmental pollution in a specific area and in a specific aspect. This study complemented its predecessors in demonstrating the danger of pollution to the health of living organisms in a new research sample whose results can be generalized to all neighborhoods in the Karkh side of the capital, Baghdad, due to the widespread diesel generators having dire negative effects on the health of the residential environment in Baghdad.

The research problem lies in the effects of air and noise pollution in the residential environment and the negative effects resulting from the intensive use of electric generators on the surrounding environment when they are operated for continuous hours during the day.

MATERIALS AND METHODS

Adopting a scientific, deductive, and analytical approach that includes on-site field surveys and field air pollution measurement devices, relying on mathematical models that illustrate the distance over which air and noise pollution spreads, determining the locations and number of generators at each site, as well as their operating duration, the type of pollutants, their effects on the residential environment, and their impact on human health.

Theoretical Structure: This project included a study of environmental pollution resulting from air and noise pollution and their impact on the populated community environment, and the resulting negative effects that are harmful to human health, despite the positive aspect of generators in filling the electricity shortage.

Air Pollution: Air pollutants are classified into two types: primary pollutants, which are emitted directly into the air. The most important of these are particulate matter, sulfur oxide, carbon oxide, hydrocarbons, and nitrogen oxides. Power plants, waste incineration, heavy industries, and transportation are among the most important sources of these pollutants. The other type of pollutants is secondary pollutants, which are formed from chemical reactions in the presence of energy (sunlight)[1] (Al-Hussaini. The Impact of Pollution. Master's Thesis year 2007 p 25)

The spread of electric power generators that run on diesel, black oil and gasoline in all sectors, homes and shops, which in turn constitutes a major pollution that harms human health and the vital environment due to the large number of them in the study area, as the number of their sites reached[9] Because of the statistical process conducted by the researcher on the study area, the generation capacity ranges between (125 kv-225 kv) and this number provides half of the fuel used to generate electrical energy, as the state provides them with fuel at the symbolic value of the fuel as support to fill the shortage of electrical energy, as for the other half of the fuel, after the researcher asks questions to the owners of the generators, The answer was to obtain it from the black market at very high prices. Because of the high price, some owners of private generators spread throughout the neighborhood (district 681) resorted to using oil because of its cheap price and mixing it with kerosene and a small percentage of engine oil and using it as fuel to operate the generators. This led to significant air pollution, as smoke comes out of the generator nozzle, especially at the beginning of its operation, However, the percentage of smoke coming out of old generators is much higher than that of modern generators, which poses a danger to the population in general and to those working in their operation and maintenance in particular, due to their proximity and constant presence next to the generator. The huge amount of smoke causes respiratory diseases, in addition to the direct impact of this smoke on the pollution of nearby home, Its effect is clear on the walls of houses, shops and schools near it, as the colour of the walls changes if it is very close, Another problem, in addition to the health problem, is the problem of contamination of clothes, trees, furniture and plants if the generator is close to shops selling clothes or home furniture or if it is located in a park surrounded by trees, These generators will damage clothes, trees and furniture,

Image 1: Emanation of quantities of air-polluting exhausts from generators in residential neighborhoods Source: Field study, photo taken on 12/22/2023

Image 2: shows air-polluting exhaust fumes emanating from generators near residential neighborhoods Source: Field study, photo taken on 2023/12/22[4]

change their colour and contaminate them with generator materials. In addition, generators near restaurants expose exposed food to contamination with generator exhaust, which leads to severe damage to most residents, as in the picture[1].

The location of generators close to residential areas has a direct negative impact on the lives of residents through the exhaust and smoke emitted by the engine nozzles, which leads to an increase in the spread of the pollution phenomenon and the occurrence of many health damages, as the direction of the nozzles (salons) is either vertical or sideways. If their direction is vertical, then this.

This causes the gases to be released upwards and then mixed with the air, which causes many diseases. However, if the generator is directed sideways, which is a common situation in most generators, then its direction in this way leads to the generator's smoke being released into nearby houses located at a distance of 25-35 meters. This distance is sufficient to directly damage roofs, balconies, and nearby shops, As the smoke emanates from nearby houses, it turns black. This trend often causes children and the elderly to become ill due to the direct flow of polluted smoke, as in Figure 2

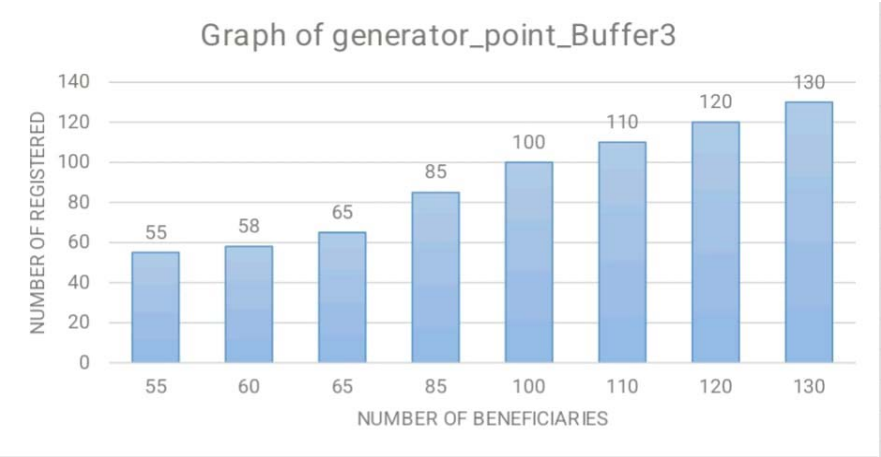
Permissible limits and standards for air pollutants emitted from electric generator exhausts according to Iraqi national specifications

The Ministry of Planning has set limits for the concentrations of air pollutants emitted from electric generators, as follows:

Source: Ministry of Planning and Development Cooperation - Central Organization for Standardization and Quality Control, Draft Iraqi Standard No (4059) / 2010 in Iraq

Gaseous Pollutants and Their Impact on Human Health: The combustion of fuel (gas oil) is the primary source of a large number of air pollutants emitted directly into the air and harmful to human health, including suspended particles, as well as some toxic gases

Map 1: Spatial distribution of generators in the study area Al-Ghazaliya, District 681
Source: Researcher's work using geographic Information Systems technology GIS 10,5



Graph 1: Showing the percentage of beneficiaries of generators according to production capacity.
Source: Researcher's work using Geographic Information Systems technology 10.5 GIS .

of pollutants emitted directly into the air and harmful to human health, including carbon monoxide, sulfur dioxide, nitrogen dioxide, hydrogen sulfide, and hydrocarbons.

Carbon Monoxide Gas (CO): Carbon monoxide is a colorless, tasteless, and odorless gas that is formed from unfavorable fuel combustion processes, as the largest proportion of carbon is converted into toxic CO. Its natural concentration in the air ranges between 0.2-0.1 parts per million, and the reason for its emission is due to combustion, Incomplete hydrocarbons[7] (Al-Dulaimi, The Impact of Climate on Human Health and Comfort in Iraq, Master's Thesis, College of Education, University of Baghdad, 1990, p. 191) .

Sulfur Dioxide Gas (SO2): Sulfur dioxide (SO2) belongs to the sulfur oxide family of gases, which are gases that dissolve easily in water and are formed when raw materials such as coal and crude oil, which contain varying proportions of sulfur, are burned. Sulfur dioxide is a colorless gas, and it dissolves in water to form sulfuric acid[8] (Shalaby, Air Pollution by Gases, Environmental Research Engineering Group, 2010)

Nitrogen Oxides (NOx): Nitrogen dioxide (NO2) is a group of highly reactive gases that contain nitrogen and oxygen in varying quantities. These oxides are colorless and odorless gases, but one of them, nitrogen dioxide (NO2), is commonly described as a dangerous air pollutant. It is red in color and has a toxic, suffocating odor. Nitrogen oxide gases are formed when fuels ignite at high temperatures, as in combustion processes, The main sources of these oxides are the activities of humans that burn fuel. Nitrogen oxides, especially nitrogen dioxide, are considered harmful gases, and they also aid combustion[9] (Zini, Air Pollution, Master's Thesis, 2000, p. 18)

Hydrocarbons (HC): These compounds consist of carbon and hydrogen and are found in nature in gaseous, liquid and solid states. Their state depends on the number of carbon atoms in the compound. When the number of carbon atoms is four or less, it is gaseous, when it is between five and ten atoms, it is liquid, and when it is more than that, it is solid, The harms of hydrocarbon pollutants are clear, especially those that come out of the exhausts of internal combustion engines, which are incompletely combusted and have a clear effect in polluting the air, because these pollutants are released in relatively small areas (the release site), and thus their effect is somewhat localized[10]. (The same source, p. 19)

Hydrogen Sulfide (H2S2): Hydrogen sulfide (H2S) is a gas with a foul odor in the surrounding air, as well as its high toxicity, which makes it one of the most annoying air pollutants. The smell of this gas is similar to the smell of rotten eggs, It is considered a very toxic gas, and its toxicity (effect factor) is tens of times greater than that of carbon monoxide. Among the dangers of this gas when its concentration increases is the loss of the ability to sense it through the sense of smell, and then poisoning by this gas without feeling it. This gas is also flammable and can be a mixture. Explosive with air and oxygen[11](Al-Zuhairi, Air Pollution in Sadr City, Iraqi Environment Magazine, Volume 1, Issue 1, 2007, p. 297).

RESULTS AND DISCUSSIONS

A careful study and location determination of the electrical generators in District 681 using GIS technology

A field survey of electrical generators using GIS technology was conducted to accurately understand the condition of generators in the Ghazaliya area, District 681, and to determine the concentrations of conventional, toxic, and hazardous pollutants, including gases such as carbon monoxide and nitrogen dioxide (NO2), Sulfur dioxide (SO2) and hydrogen sulfide (H2S) gases emitted from the exhausts of electric generators. A number of electric generators operating on gas oil have been observed, as shown in Map 1.

These generators selected for the study were distributed in different alleys within the study area based on the difference in their generating capacities. The generating capacity of these generators ranged between (250_125) kV, as each site contains a number of adjacent generators with different sizes and electricity production capacities, based on the different uses of the area according to the generators' operating hours and the amount of gaseous pollutants emitted during the operating period.

Table 1: Maximum permissible limits for air pollutants emitted from electric generator exhausts for one hour

Pollutants	Maximum permissible limits
Carbon monoxide CO3 (PPM)	0.26
Sulfur dioxide SO2 (PPM)	0.14
Nitrogen dioxide NO2(PPM)	0.05
Hydrogen sulfide H2S (PPM)	0.005

Ppm=3PPM

The practical study included the following:

- Conducting a field survey of the generator sites and identifying them on a map.
- Determining the number of generators at each site.
- Determining the daily operating hours of the generators selected for the study, as they typically operate between 7_14 hours per day .
- Classify generators as residential or commercial, and then determine which ones are predominantly residential.

The following is an illustrative table showing the number[4] of generator sites, the number of generators in each site, the size (kv) of the generators, their identification on the map, attached to the alley number, the number of beneficiaries, and the type of generator, whether it was silent or noisy. This has been explained in the following table according to the Geographic Information Systems (GIS) system. This information is displayed in the form of two maps, the first to identify the generator sites and the second to identify the noise level, as well as a graphic representation showing the number[1] and percentages of beneficiaries of these generators.

The researcher found from the field study that the pollution resulting from generators near homes and the black smoke falling on those homes led to most of their children suffering from respiratory diseases, especially children under the age of 6 years, And also the smell of exhaust fumes (smoke), which if it increases in some old, used generators, causes cases of suffocation and dizziness even for the elderly. This is in generators very close to residential areas or planted between the floors. As for generators installed in open areas such as parks or abandoned, uninhabited areas, the pollution and its effect on residential areas is less.

The climate here plays a role. If the wind is blowing towards the neighbourhood, the smoke will fall on the houses and gardens facing it. The wind also changes the facades of the houses and decorates them with a polluted black colour, changing their beautiful shapes to the colour of the exhaust emitted from the source.

Table 2: A comprehensive (10,5) GIS illustrative table showing the number of generators and their usage at each location

Generator Type	Number of beneficiaries	Alley number	Generator size	Number of generators	Shape	Object ID
Noise	58	9	125	4	Point	1
Noise	65	10	225	4	Point	2
Noise	100	9	225	5	Point	3
Noise	55	11	115	3	Point	4
Muffler	85	18	125	4	Point	5
Noise	130	19	250	5	Point	6
Noise	100	21	135	4	Point	7
Noise	110	21	125	4	Point	8
Muffler	120	13	125	5	Point	9

CONCLUSION

Operating for long hours contributes to the accumulation of these gases in the atmosphere surrounding the generator, causing air and noise pollution in residential areas, as evidenced by the following results. The concentration of all these gases (CO, NO2, SO2, H2S) was clearly higher than the environmental specifications and determinants of pollutants emitted by generators. The concentration of these gases emitted by all generators selected for the study exceeded the national specifications and determinants. Increasing air temperature increases the speed of noise, and the intensity of noise is also affected by wind speed and direction, which affects the transmission of noise and thus its intensity, as the difference in wind speed near the Earth's surface from what it is in the upper layers affects the transmission of noise. The results showed a clear decrease in the concentration of all gases (CO, NO2, SO2, H2S) when moving away from the emission source, i.e. from (generators) and at distances (2m, 5m, 10m), which indicates the state of dispersion of these gases when moving away from the emission source. The study proved the existence of clear differences in the concentration of these gases emitted from the generators selected for the study, which are attributed to the type of generator and its generating capacity. It was shown that the age factor of the generator used has a large and clear effect on the differences in the concentration of gases emitted from the generators.

Recommendations:

1. Equip generators with filters to help reduce exhaust emissions, which are accompanied by toxic gases that are harmful to the environment.
2. The generator site must be selected in accordance with the climatic conditions of the region and located in the direction of the prevailing winds to avoid the disadvantages of smoke inhalation and to avoid noise.
3. Work is underway to create multi-walled soundproof rooms to reduce the noise generated by generators operating for long hours.
4. Generator owners are required to perform periodic maintenance on engines, and lubrication is essential to reduce the emission of pollutants resulting from engine wear and tear due to prolonged use.
5. Installing large generators with high production capacity instead of multiple generators, and placing them outside residential areas to reduce environmental pollution resulting from their increased number.
6. Surrounding generator sites with evergreen trees to benefit from them as a buffer against suspended particles from smoke emissions and to create a suitable environment in which there is a quantity of oxygen needed to oxidize pollutants resulting from multiple pollutants.
7. Studying the possibility of developing an electronic scale that predicts the concentration of pollutants resulting from these generators.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

REFERENCES

1. Ahmed Al-Khatib, Soil Pollution, st ed., Faculty of Agriculture, Alexandria University, 2008 .
2. Saadia Abdul-Kadhim Al-Zuhairi, Air Pollution in Sadr City, Iraqi Environment Journal, Volume1, Issue 1, 2007 .
3. Salah Mahdi Ali Zini, Air Pollution in Industrial Facilities in Baghdad, Master's Thesis, College of Engineering, University of Technology,2000
4. Mahdi Hamad Farhan Al-Dulaimi, The Impact of Climate on Human Health and Comfort in Iraq, Master's Thesis, College of Education, University of Baghdad,1990
5. Heba Shalaby, Air Pollution by Gases, Environmental Engineering Research Group,2010
6. Ministry of Planning and Development Cooperation - Central Organization for Standardization and Quality Control, Draft Iraqi Standard No(4059) in Iraq in 2010.
7. Yusra Badri Nour Al-Hussaini, The Impact of Pollution by Suspended Materials and its Impact on the Environment, Master's Thesis, College of Science, Al-Mustansiriya University,2007 .