

Assessment of the environmental reality in Alharfiyin in the city of Najaf, Iraq

Safaa M. Almudhafar¹, Rusul Z. Almudhafar², Zainab A. ALzurfi³, B. A. Almayahi⁴

^{1,2,3} Department of Geography, Faculty of Arts, University of Kufa, Najaf, Iraq

⁴Department of Physics, Faculty of Science, University of Kufa, Najaf, Iraq

*basim.almayahi@uokufa.edu.iq; safaa.almudhafar@uokufa.edu.iq

How to cite this article: Safaa M. Almudhafar, Rusul Z. Almudhafar, Zainab A. ALzurfi, B. A. Almayahi, (2024). Assessment of the environmental reality in Alharfiyin in the city of Najaf, Iraq. *Library Progress International*, 44(3), 13493-13500.

ABSTRACT

This research evaluates the environmental conditions in the Harfiyin neighborhood of Najaf, Iraq, focusing on solid, liquid, and gaseous pollutants from industries. A field survey revealed significant waste, particularly solid waste from factories, and a large landfill contributing to air pollution. The presence of smoke, fumes, and toxic gases affects residents' health. Laboratory tests confirmed high levels of pollutants in the soil. Four samples were collected to assess the environmental impact. The results show a significant presence of solid waste, in line with international standards.

Keywords: Harfiyin, environmental assessment, pollutants, solid waste, health impacts.

Introduction

The Craftsmen District is one of the important industrial areas in the city of Najaf because of its great importance in the production of many important industries that serve the city and its residents [1-4]. The Craftsmen District is located to the south-east of the city of Najaf and surrounded by a group of residential neighborhoods, the most important of which are (Ansar - Jerusalem - Imad Sukkar - Airport). There are many construction industries in the region, the most important of which are (iron - wood carpentry - aluminum - glass - kashi and stacker - sandwiches - arrow water - juices - dairy) and other industries that serve the city. The artisan's neighborhood is characterized by its large area, which includes hundreds of factories and Laboratories, but the number of factories and Laboratories inside the neighborhood exceeds the area of the area [5-8]. Therefore, when looking at them, we find that the factories and Laboratories are characterized by small and narrow area. When conducting a field study of this area. It was found that it suffers from very large pollutants as a result of the acquisition of iron industry factories by a large percentage of up to 50% compared to other industries, and this in turn increases pollutants as a result of solid and gaseous pollutants, soil pollution and air pollution, followed by wood carpentry, which accounts for 30%, and the other part of the industries takes 20% [9-12]. After conducting a field survey of this area, a place was found at the end of the neighborhood dedicated to the neighborhood's garbage dump and neighboring neighborhoods, as it took up a large area, which led to the poor environmental reality in the area, and it was found that workers in this area suffer from cancerous diseases as a result of the toxic gases in these factories, as well as the effects of these industries crossed the borders of the region and crossed into locations [13-16]. The Al-Harfiyin neighborhood in Najaf, Iraq, plays a vital role in the local economy as a bustling industrial hub. Home to a diverse array of industries, including iron Laboratories, carpentry, and aluminum factories, this area significantly contributes to employment and economic development. However, the industrial activities in Al-Harfiyin have led to severe environmental challenges, notably high levels of pollution that threaten the health and well-being of its residents and workers [17-20]. This study aims to investigate the extent of pollution in Al-Harfiyin, focusing on solid, liquid, and gaseous pollutants, and to assess their impact on the environment and public health. By conducting field surveys and Laboratories tests, the research seeks to provide

a comprehensive understanding of the pollution sources and levels, ultimately offering recommendations for effective waste management and pollution control measures to improve the quality of life in this industrial neighborhood.

Does the artisan district suffer from pollutants that affect the environmental reality in the city.

The area of the craftsmen neighborhood suffers from a large number of wastes, especially solid waste, because the Laboratories present waste from these industries that affect the environmental reality of the region.

The area of Al-Harafi 'in neighborhood is one of the important areas in Najaf Governorate because of its great importance in producing many industries that serve the entire city and meet the needs of the population.

Al-Harafi 'in neighborhood is located to the southeast of the center of Najaf. It is 6.4 km away from the city center. It is located between a number of main and secondary roads, the most important of which is Al-Qawsi Street 2, which is bordered to the east and southeast. It is bordered to the west by Al-Ansar neighborhood, to the southwest by Al-Quds neighborhood, to the north by Al-Sawq, Al-Qadisiyah and Al-Zahraa, and to the east by Najaf International Airport.

Industry is the process of transforming raw materials into goods or services. In Najaf, industrial development has expanded rapidly, particularly in the artisans' neighborhood, which covers 1,487,500 m² and employs over 10,000 workers. These industries are key to economic growth but have caused environmental concerns.

Key industries include:

Blacksmithing: Makes up 50% of the factories, producing iron scrap that pollutes the soil.

Carpentry: Accounts for 30%, with little waste as wood residues are sold.

Al-Kashi and Al-Shayaker: 5%, producing cement and plaster waste that affects the soil.

Aluminum: 4%, with waste disposed of outside the area.

Dairy and Juice: Less than 4%, generating liquid waste that contributes to water pollution.

Table 1 Types of Industries [21]

Type of industry	Number of workers	Area of each workshop (m ²)	Percentage
Blacksmithing	5000	743,750,000	50%
Carpentry	2,500	371,875	30%
Aluminum	500	22,600	2%
Mosaic Tile	900	92,750	5%
Diary	250	45,700	4%
Flour	150	11,593	1%
Ice Labs	500	23,187	2%
Warehouses	250	23,175	2%
Glass Laboratories	300	46,375	3 %
Plastic Factory	500	92,75	5%

Plastic Factories: These factories make up less than 5% of the total, with around 500 workers and an area of 92.75 m². Only 20 labs exist compared to iron factories in the area (Fig. 5). They face issues with solid waste disposal, with damaged materials being discarded while the rest is appropriately recycled. Arrow and Ice Water Factories: Located in the Harfiyin neighborhood, there are fewer than 10 factories, including two ice-making plants and under 8 Arrow water production factories. They employ fewer than 500 workers and cover 23,187 m². Field studies (Figs. 1a-d, Table 1) show no significant pollutants, though the equipment used is of poor quality. Flour Factory: The area has one large flour factory, employing 150 workers and occupying 11,593 m² (1% of the total area as shown in Table 1). Entry to the factory is restricted, but from outside, no solid or liquid waste was visible near the gate. Warehouses: The warehouses in Al-Harfani neighborhood cover 23,175 m² (3%) and employ 250

workers. A field study revealed significant solid waste near these warehouses, mostly discarded by nearby factories, contributing to the area's poor environmental conditions. Glass Factories: These factories, located in the center of the artisans' neighborhood, span 46,375 m² with 300 workers (4% of the area, as in Table 1) [22][23].



Figure 1 a.Carpentry Laboratories, b.Aluminum laboratories, c.Plastic factory, d.Ice factory

Waste from these factories is disposed of in landfills due to its potential hazards. Basic Facilities in Al-Harfani Neighborhood: The neighborhood includes residential units and a recreational yard (Figs. 2a-d). There is one low-quality restaurant for factory workers, and most residents rely on nearby restaurants. The area has a football field where children play, but houses at the end of the neighborhood suffer from poor construction. Residents face health issues, including bronchial diseases and cancer, as well as noise pollution from factory operations (7 am–6 pm). Industrial activity in the area has declined due to cheaper imports, leading to the closure of some factories like a sewing factory. The focus is now on iron, wood, and aluminum industries. Industries and Laboratories in the study area include many of the wastes that they put near or far from factories. These wastes, in turn, increase the concentration of industrial pollutants near them. These wastes are of the following types. Represented by iron scrap, sawdust residues, waste from other laboratories and Laboratories. There is also an area in the study area that is considered a solid waste dump in very large quantities. It should be noted that the study area has solid waste in huge quantities. In addition, this place is considered a landfill for the waste of other areas. When looking at the study area, you find that solid waste constitutes more than 60% because most of the laboratories and neighboring areas produce solid waste in large quantities, which in turn affects the soil characteristics of the study area.



Figure 7 a. Flour Factory, b. Playground, c. Residential houses, d. Landfill

This waste is represented by the oils and fats thrown by the laboratories. When the field study of the study area found that this type of waste exists only in a small percentage, and this is due to the fact that the study area does not produce liquid waste compared to solid waste. These wastes are represented by volatile dust, dust atoms, and the study area does not suffer from gaseous wastes, even if they are 1%, because these plants do not release gases to the atmosphere and thus are deposited on the soil and affect its characteristics. The environmental assessment of the Al-Harfiyyin neighborhood area is represented by analyzing the chemical elements of the soil of the study area and includes the sampling sites, as (4) samples were selected and collected from different sites based on the field survey of the area as well as the random method and the sites as follows:

- 1) A sample near the blacksmithing factories and Laboratories.
- 2) Sample near carpentry factories and Laboratories.
- 3) Sample near aluminum plants.

Out near the old mission garbage tip.

pH Measurement: The Ohaus Starter is calibrated with a Planck device and distilled water. Soil samples are mixed, shaken, filtered, and the reading is taken from the filtrate. EC Measurement: Using the Flame Photometer, soil samples are mixed, shaken, and filtered. The electrical conductivity is measured from the filtrate. Calcium, Magnesium, Sulfates Measurement: Using the Flame Photometer, a standard solution is prepared with distilled water. The sample is mixed with water and drops of bicarbonic acid, shaken until it turns orange. EDTA is added until the solution turns blue, and the reading is taken. Heavy Elements Measurement: Soil samples are dried at 70°C for 24 hours, ground, sieved, and weighed. The sample is mixed with hydrochloric acid, centrifuged, and the leachate is measured with an optical applicator to record the result. Table 2 shows that the hydrological exponent (pH) values in the soil of the study area vary across different locations. According to the American Salinity Laboratories' soil classification, the pH ranges from neutral to slightly basic (Table 3). The first sample, taken near the landfill, recorded a neutral pH of 7.5. The second sample, from the blacksmithing Laboratories, had a pH of 7.7, leaning towards basic. The third sample, from scattered areas and aluminum Laboratories, had a pH of 8.2, indicating a higher basicity. The final sample from the woodworking Laboratories had the highest pH at 8.6, reflecting increased alkalinity. This variation is influenced by the presence of iron and aluminum dust, which raises pH levels in the soil.

Table 2 Hydrological values (pH) for the soil of the study area

Location	Ratio (pH)
Sample 1	7,5
Sample 2	7.7
Sample 3	8.2
Sample 4	8.6

Table 3 Global standard (pH) according to the American Salinity Laboratories standard [22]

Soil Reaction	Soil Characteristic
Less than 4.5	Ultra-acid
4.5-5	Very acidic
5-5.5	Extremely acidic
5.5-6	Medium acidity
6-7	Mildly acidic

7	Neutralize
7-8	Moderate Basal
8–8.5	Medium Basal
8.5-9	Very basic
More than 9 months	Very very basic

Table 4 reveals varying electrical conductivity (EC) levels in the soil across different locations in the study area, influenced by climatic factors. The highest EC was recorded near aluminum laboratories (17.31 mg/cm), indicating high salinity, as classified by the American Salinity Laboratories (Table 5). Blacksmithing Laboratories showed a concentration of 10.3 mg/cm (also high salinity), while the landfill site had a medium salinity level of 8.9 mg/cm. Carpentry Laboratories had the lowest EC at 3.5 mg/cm, indicating low salinity due to minimal chemical waste. These variations are attributed to the soil type and texture across locations.

Table 4 Concentrations (EC) of the electrical connection to the soil of the study area

Location	Concentrations (EC) mL/cm
Sample 1	17.31
Sample 2	10.3
Sample 3	8.9
Sample 4	3.5

Table 5 American Salinity Laboratories (USDA) classification of soil salinity [23]

Electrical Connection Nippled/cm	(EC)	Soil Class
0-4		Low salinity
4-8		Medium salinity
8-15		high salty
More than 15		Very high

Table 6 and Figure 3 show that sulfate concentrations in the soil of Al-Harfiyin vary across different locations. The lowest concentration was recorded in front of the blacksmithing Laboratories (1.64 mg/L), while higher levels were found near the landfill (2.24 mg/L) and aluminum factories (24 mg/L) due to sulfur oxide emissions. Carpentry Laboratories had moderate concentrations (7 mg/L). Compared to international standards, sulfate levels are generally low, attributed to the nature of the materials and lower sulfurization in industries.

Table 6 Percentage of chemical elements (sulfate -calcium - magnesium) in the study area

Sample type	Sulphates mg/l	Calcium liter	Mg mg/l
Sample 1	224	50	90
Sample 2	164	46	140
Sample 3	240	140	120

Sample 4 170 130 160

Table 7 The global standard for saline elements of (U.S.D.A) PPM [24]

Element	Low salinity	Medium salinity	High salty
Sulphates	Under 100	100-200	200
Calcium	Less than 150	100-150	More than 150
Magnesium	Less than 50%	50-100	More than 100

From Table 6, calcium concentrations in the study area's soil vary by location, as per the American Salinity Laboratories' standard for saline elements (Table 7). The highest calcium concentration was recorded near the landfill (50 mg/L), followed by the blacksmithing labs (46 mg/L) and aluminum labs (40 mg/L). The high calcium levels are attributed to the climate (temperature) and soil texture, which favor calcium accumulation, along with industrial activities that release calcium-rich waste. The lowest calcium concentration was near the carpentry labs (30 mg/L), where activities don't produce significant calcium residues. Compared to global standards, calcium concentrations are relatively low. Magnesium concentrations also vary, with the highest levels near the aluminum labs (20 mg/L) due to magnesium-rich waste, followed by the blacksmithing labs (14 mg/L). The landfill area had a magnesium concentration of 9 mg/L, and the carpentry labs had the lowest at 6 mg/L. Compared to global standards, all sites exhibit very low salinity levels, likely due to the soil's texture and the low magnesium content in the waste. Cadmium concentrations, according to Pratt's 1972 classification for heavy elements (Table 8), ranged from 0.2 to 3 mg/L across four areas. At the blacksmithing labs, cadmium levels (0.2 mg/L) were within permissible limits, while at the aluminum labs, the concentration (1.7 mg/L) exceeded the global standard. The carpentry labs had the lowest cadmium concentration (0.03 mg/L), well within safe limits. The landfill area recorded 0.9 mg/L, slightly above the normal limit. High cadmium concentrations in some areas are due to industrial waste containing elevated element levels [24][25][26].

Table 8 Maximum concentrations of heavy elements according to classification (pratt1972)

Elements	Maximum allowable limit mg /l
Lead pb	0.5
cadmium cd	0.1-0.5
Nickel ni	0.20
Copper (Cu)	0.20
Iron Fe	0.5
Aluminum	0.3
zinc zn	0-1Low 1.5Medium 1.5 and above High

According to Table 9, iron concentrations in the study area ranged from 2.4 to 4.9 mg/L. The blacksmithing labs recorded the highest level (4.9 mg/L), significantly exceeding permissible limits. The aluminum labs showed a concentration of 2.9 mg/L, also surpassing global standards. The carpentry labs had a concentration of 2.5 mg/L, which was similarly high, while the landfill area registered 2.4 mg/L. These elevated iron levels are attributed to industrial waste, particularly from the blacksmithing labs, which produce iron filings that contribute to higher soil concentrations. Lead levels ranged from 2.1 to 3.2 mg/L. The blacksmithing labs again recorded the highest level

(3.2 mg/L), exceeding permissible limits. Aluminum labs showed 2.2 mg/L, also above the global standard. The carpentry labs registered 2.1 mg/L, exceeding the limit, while the landfill area recorded 1.1 mg/L. The high lead concentrations stem from industrial waste, particularly from the blacksmithing labs, which release significant amounts of lead into the soil. Nickel concentrations varied between 0.1 and 3.4 mg/L. The blacksmithing labs had the lowest concentration (0.1 mg/L), within safe limits. However, aluminum labs showed 3.4 mg/L, exceeding global standards. The carpentry labs registered 2.1 mg/L, while the landfill area remained within permissible limits. Elevated nickel levels are linked to waste from aluminum labs, which contribute to high concentrations of this element. Copper concentrations ranged from 1.1 to 2.4 mg/L. The blacksmithing labs recorded 2.1 mg/L, within permissible limits. Aluminum labs reached 2.4 mg/L, exceeding global standards. The carpentry labs had 1.1 mg/L, while the landfill area showed 0.04 mg/L, within safe limits. High copper concentrations, especially near aluminum labs, result from industrial waste containing significant copper. Aluminum concentrations ranged from 0.1 to 4.1 mg/L. The blacksmithing labs had 0.1 mg/L, within safe limits, while aluminum labs reached 4.1 mg/L, surpassing global standards. The carpentry labs recorded 3.5 mg/L, exceeding limits, while the landfill area was within permissible limits (0.05 mg/L). Waste from aluminum labs contributes to high aluminum concentrations in the soil. Zinc concentrations ranged from 0.1 to 1.5 mg/L. The blacksmithing labs recorded 0.1 mg/L, within safe limits. Aluminum labs showed 1.5 mg/L, exceeding permissible limits, while the carpentry labs registered 1.1 mg/L, also above the standard. The landfill area had the highest concentration (2.2 mg/L). Elevated zinc levels are primarily due to waste from aluminum labs.

Table 9 Concentrations of the heavy metals (mg/l) of the soil of the study area

Sample type	Zinc	Aluminum	Copper	Nickel	Lead	Fe	Cadmium
Sample 1	0.1	0.1	2.1	0.1	3.2	4.9	0.2
Sample 2	1.5	4.1	2.4	3.4	2.2	2.9	1.7
Sample 3	1.1	3.5	1.1	2.1	2.1	2	0.03
Sample 4	2.2	0.05	0.04	0.1	1.1	2.4	0.9

Conclusions

Al-Harfiyin in Najaf, Iraq, is a key industrial area with significant pollution issues. This study examines pollutants from industries like iron, carpentry, and aluminum, revealing high contamination levels, especially from iron waste, which affects soil and causes health problems like bronchial and cancerous diseases. Blacksmithing and aluminum factories are the main polluters. The research calls for improved waste management, recycling, and stricter regulations to reduce environmental and health risks, promoting a cleaner and more sustainable community.

References

- [1] Almudhafar, S.M. Spatial Variation of Biological Contamination of Soil from Najaf City. *Indian Journal of Environmental Protection* this link is disabled, 2020, 40(2), pp. 196.
- [2] Almudhafar, S.M., Alattabi, I.A. Effect of environmental factors on drainage water network in Najaf governorate, Iraq. *Indian Journal of Environmental Protection* this link is disabled, 2019, 39(11), pp. 1050
- [3] Almudhafar, S. M. Environmental assessment of shut alkufa in Iraq. *Plant Archives*, 2018, 18(2), pp. 1551
- [4] Almudhafar, S.M., Abboud, H.A. Spatial variation of surface water contamination by heavy elements in Alhira relative to tourism. *African Journal of Hospitality, Tourism and Leisure*, 2018, 7(4)
- [5] K. R. Kadhim, S. Almudhafar, B. A. Almayahi, 2023. An environmental assessment of the non-living natural resources and the available capabilities and their investment in Al-Najaf Governorate, *HIV Nursing* 23 (3), 265–273
- [6] IA Alattabi, SM Almudhafar, BA Almayahi (2023). Natural constituents of the elements affecting soil pollution and health effects and changing their properties by wastewater in Najaf district center, *Solid State Technology* 63 (6), 5438-5452.

- [7] Safaa M. Almudhafar, B.A. Almayahi and Hanan H. Jawad. Effect of Environmental Parameters on Soil Salinity on Plant. Volume 24, Issue 5, 2020. Pages: 4247-4253. Doi: 10.37200/IJPR/V24I5/PR2020140.
- [8] Abdil-Ameer Noor T., Almudhafar Safaa M., Almayahi B. A. Environmental assessment of solid waste collection sites in Najaf Governorate. International J. Ecomedical and Public Sciences, (IJEPS) 5 (4): 01-05 (2022).
- [9] Abyss, K. D., Almudhafar, S. M., Almayahi, B. A. The right of disabled children in Iraqi. International Journal of Health Sciences, 2022, 6(S4), 47269-47276. <https://doi.org/10.53730/ijhs.v6Ns7.13129>
- [10] Khalid R. Kadhim, Safaa Almudhafar, B. A. Almayahi. An environmental assessment of the non-living natural resources and the available capabilities and their investment in Al-Najaf Governorate. HIV Nursing 2023, 23 (3): 265-273.
- [11] Narayan, V., Mehta, R. K., Rai, M., Gupta, A., Singh, M., Verma, S., ... & Yadav, S. (2017). E-Commerce recommendation method based on collaborative filtering technology. International Journal of Current Engineering and Technology, 7(3), 974-982.
- [12] Narayan, V., Mehta, R. K., Rai, M., Gupta, A., Tiwari, A., Gautam, D., ... & Sagar, V. (2017). To implement a web page using thread in Java. International Journal of Current Engineering and Technology, 7(3), 926-934.
- [13] Awasthi, S., Srivastava, A. P., Srivastava, S., & Narayan, V. (2019, April). A comparative study of various CAPTCHA methods for securing web pages. In 2019 International Conference on Automation, Computational and Technology Management (ICACTM) (pp. 217-223). IEEE.
- [14] Narayan, V., & Daniel, A. K. (2020). Design consideration and issues in wireless sensor network deployment.
- [15] Babu, S. Z., Pandey, D., Narayan, V., Al Zubayer, A., & Sheik, I. (2020). Abridgement of Business Data Drilling with the Natural Selection and Recasting Breakthrough: Drill Data With GA. Authors Profile Tarun Danti Dey is doing Bachelor in LAW from Chittagong Independent University, Bangladesh. Her research discipline is business intelligence, LAW, and Computational thinking. She has done, 3.
- [16] Narayan, V., Babu, S. Z. D., Ghonge, M. M., Mall, P. K., Sharma, S., Srivastava, S., ... & Tyagi, L. K. (2023). 7 Extracting business methodology: using artificial intelligence-based method. Semantic Intelligent Computing and Applications, 16, 123.
- [17] Noor T. Abdil-Ameer, Safaa M. Almudhafar, B. A. Almayahi. The Natural Characteristics Affecting the environmental pollution Contrast at the Center of Al-Manathira District. International Journal of Academic Multidisciplinary Research, Vol. 7 Issue 1, January - 2023, Pages: 166-175
- [18] Huda S. Abdel Wahhab, Safaa M. Almudhafar, Ahmed S. Alalaq, B. A. Almayahi. Social Environment and Its Effects on Domestic Violence. Rev. Gest. Soc. Ambient Miami, v.17.n.7, p.1-14, e03536, 2023.
- [19] Safaa M. Almudhafar, Noor T. Abdulameer, Basim A. Almayahi. Environmental Assessment of Surface Water Contamination with Pathogenic Bacteria in the Manathira District Center, JCHR (2023) 13(3), 1067-1077.
- [20] Safaa M. Almudhafar, Russel Alaa Mohsen, Basim A. Almayahi. Environmental Assessment of the Impact of Water Pollution in the Bahar Al Najaf on Plants. JCHR (2023) 13(3), 1036-1046.
- [21] Safaa M. Almudhafar, Azhar Rahman Sweihi, Basim A. Almayahi. Spatial Analysis of Surface Water Contamination with Pathogenic Fungi Resulting from Sewage Sites in Najaf Al-Ashraf Governorate. JCHR (2023) 13(3), 996-1011.
- [22] Safaa M. Almudhafar, Noor Tahseen Abdulameer, Basim A. Almayahi. The Impact of Pathogenic Fungi on Soil Contamination in the Center of the Al-Munadhirah District. JCHR (2023) 13(3), 1056-1066.
- [23] Hassan Abdullah Hassan, Safaa M. Almudhafar, Iman A. Al Atabi, B. A. Almayahi. Environmental Factors Affecting Surface Water in Al Mishkhab District. Migration Letters, 2023, Volume: 20, No:7, pp. 2 61 2 76.
- [24] Safaa M. Almudhafar, Maryam A. Rahim, Basim Almayahi. Spatial Analysis of Household Waste's Impact on Soil and Air Pollution. IJEP 44 (2): 52-685 (2024).
- [25] Samer H. Kadhem Al-Jashaami, Safaa M. Almudhafar, Basim A. Almayahi. A Spatial Analysis of the Influence of Environmental Factors on the Growth and Proliferation of Pathogenic Fungi in the Manathira River. Kurdish Studies, 2024, Volume: 12, No: 2, pp.5450-5461.
- [26] Samer H. Kadhem Al-Jashaami, Safaa M. Almudhafar, Basim A. Almayahi. The Effect of Climate on the Variation of Pathogenic Bacteria in the Waters of the Manathira River. Kurdish Studies, 2024, Volume: 12, No: 2, pp.2330-2341.