JAES | JOURNAL OF APPLIED ENGINEERING SCIENCE | www.engineeringscience.rs
ISTRAŽIVANJA I PROJEKTOVANJA ZA PRIVREDU

Indexed by

# STUDY THE EFFECT OF OPERATING OF THE NORTH AND SOUTH AL DIWANIYAH POWER PLANTS ON THE CITY OF AL DIWANIYAH

***Abdulrazzaq Abdzaid Hussein***
*Department of chemical Engineering, College of Engineering, Al-Qadisiyah University, Al-Qadisiyah, Iraq*

***Fawzi Sh. Alnasur***
*College of Science, Al-Qadisiyah University, Al-Qadisiyah, Iraq*

***Ahmed Ch. Almansoori***
*Department of chemical Engineering, College of Engineering, Al-Qadisiyah University, Al-Qadisiyah, Iraq*

***Mushtaq A. AL-Furaiji***
*Faculty of Cryogenic Engineering, ITMO University, Kronverksky prospect, 49, St. Petersburg, 197101, Russia*
*Department of Mechanical Engineering, College of Engineering, University of Misan, Al Amarah, 10062, Misan, Iraq*

***Key words:*** *power plant, pollution, Al Diwaniyah city, heavy elements*
**doi:10.5937/jaes0-32922**

***Cite article***:

Abdzaid Hussein A., Sh. Alnasur F., Ch. Almansoori A., A. AL-Furaiji M. (2022) STUDY THE EFFECT OF OPERATING OF THE NORTH AND SOUTH AL DIWANIYAH POWER PLANTS ON THE CITY OF AL DIWANIYAH, *Journal of Applied Engineering Science*, 20(2), 346 - 350, DOI:10.5937/ jaes0-32922

***Online aceess*** *of full paper is available at: www.engineeringscience.rs/browse-issues*

Original Scientific Paper

Istraživanja i projektovanja za privredu
Journal of Applied Engineering Science

**doi:**10.5937/jaes0-32922 Paper number: 20(2022)2, 938, 346-350

# STUDY THE EFFECT OF OPERATING OF THE NORTH AND SOUTH AL DIWANIYAH POWER PLANTS ON THE CITY OF AL DIWANIYAH

***Abdulrazzaq Abdzaid Hussein[1,*], Fawzi Sh. Alnasur[2], Ahmed Ch. Almansoori[1], Mushtaq A. AL-Furaiji[3,4]***
***[1]Department of chemical Engineering, College of Engineering, Al-Qadisiyah University, Al-Qadisiyah, Iraq***
***[2]College of Science, Al-Qadisiyah University, Al-Qadisiyah, Iraq***
***[3]Faculty of Cryogenic Engineering, ITMO University, Kronverksky prospect, 49, St. Petersburg, 197101, Russia***
***[4]Department of Mechanical Engineering, College of Engineering, University of Misan, Al Amarah, 10062, Misan, Iraq***

*This study was conducted to find out the impact of two diesel plants (southern and northern) of the city of Al Diwaniyah by studying the concentrations of some heavy elements (Cu, Pb, Zn, Mn and Fe) in the soil and plants around the two stations as a result of operating with heavy fuel and the absence of techniques for filtering exhaust waste. The results showed that heavy metals in plants are higher than their concentration in the soil. Moreover, the highest percentage of contamination with heavy elements for each of Fe, Zn, Mn, Cu and Pb in the soil is 293.1, 133.8, 365, 55, 46 and 0.093 mcg/gm, respectively against, 440, 201.8, 446, 130,98 and 35.12 mcg/gm in the plant. These percentages are higher than the recommended values, according to the World Health Organization (WHO). The results also showed that the pollution level from heavy metals in soil and plant samples was higher in the areas south of the two stations. The lowest values were located to the north of stations because the wind blew from north to south, carrying the pollutants most of the year. This has resulted from the incomplete combustion of heavy fuel in the two plants to the populated city center, located to the south of the North Al Diwaniyah station.*

*Key words: power plant, pollution, Al Diwaniyah city, heavy elements*

## INTRODUCTION

Since the onset of the industrial revolution, pollution of the environment with toxic metals has been increased dramatically [1]. Although heavy metals such as cadmium, lead, chromium, and copper are naturally present in the soil, the contamination could come from local sources. These sources are primarily industrial (power plants, non-ferrous industries, iron, steel and chemical industries), agriculture (irrigation with polluted waters, sewage sludge and fertilizers (especially phosphates), contaminated manure and pesticide containing heavy metals, waste incineration, combustion of fossil fuels and road traffic. Long-range transport of atmospheric pollutants adds to the metals in the natural environment [2]-[7]. In recent years, it has been shown that lead levels in soil and vegetation have increased considerably due to traffic pollution, especially from the usage of leaded petrol and exhaust combustion [8]. This problem increase as daily traffic increases [9]. Heavy metals can be found generally at trace levels in soil and vegetation, and living organisms feel the need for micro-elements of these metals. However, these have a toxic effect on organisms at high levels. Heavy metal toxicity has an inhibitory effect on plant growth, enzymatic activity, stoma function, photosynthesis activity and accumulation of other nutrient elements, damaging the root system [10]. It is known that the production and use of energy from its various traditional sources cause many types of environmental pollution with harmful effects on the components of the environment, such as air, water, and land, leading to the imbalance prevailing in them. In general, pollution poses many risks due to its direct and indirect impact on human health due to the contamination of food, water, and air sources [11]. Combustion of different fossil fuel types such as natural gas, diesel, and heavy oil for electricity production in power plants produces a pollutant of a complex mixture in the atmosphere. This includes SOx, NOx, CO, heavy metals, acid gases, and organic compounds, solid wastes (such as ash) represents serious environmental issues [12]-[21]. Despite its possession of various renewable energy sources such as solar energy, wind energy, and biofuels (cane, rice straw, wheat, barley, and corn), Iraq relies entirely on fossil fuels to operate the electrical power stations across the country [13]. Studies on environmental pollution by heavy metals from power plants in Iraq are limited. In Al- Qadisiyah Governorate, the pollution resulting from the operation of the electricity-generating stations in the north and south of the governorate, which operate with heavy oil, is considered one of the most significant pollutants in the city in addition to the sound pollution (noise). This study shows the percentage of pollution in the soil and plant with heavy elements around power stations in different Al- Qadisiyah city regions. This research also highlights

*razaq.a.zaid@qu.edu.iq

## RECOMMENDATIONS

For establishing new power stations in the future, choosing the appropriate and thoughtful place must be done considering the impact of their emissions on the population and plants and the proximity to fuel sources.

- Using specialized filters for engine exhaust in the stations, such as (cyclone collector, static pole, bag) to reduce environmental pollutants.
- Reducing impurities and purifying used fuel as much as possible in the two stations to try to reduce harmful emissions.
- Seeking and planning to use renewable and environmentally friendly energy sources.

## REFERENCES


1. Denholm, P., Hand, M., Jackson, M., & Ong, S. (2009). Land use requirements of modern wind power plants in the United States (No. NREL/TP-6A2-45834). National Renewable Energy Lab. (NREL), Golden, CO (United States).
2. Ouyang, W., Hao, F. H., Zhao, C., & Lin, C. (2010). Vegetation response to 30 years hydropower cascade exploitation in upper stream of Yellow River. Communications in Nonlinear Science and Numerical Simulation, 15(7), 1928-1941. doi.org/10.1016/j.cnsns.2009.07.021
3. Cabrera, F., Clemente, L., Barrientos, E. D., López, R., & Murillo, J. M. (1999). Heavy metal pollution of soils affected by the Guadiamar toxic flood. Science of the TotalEnvironment , 242(1-3), 117-129. doi.org/10.1016/S0048-9697(99)00379-4
4. Simón, M., Ortiz, I., Garcıa, I., Fernández, E., Fernández, J., Dorronsoro, C., & Aguilar, J. (1999). Pollution of soils by the toxic spill of a pyrite mine (Aznalcóllar, Spain). Science of the Total Environment, 242(1-3), 105-115. doi.org/10.1016/S0048-9697(99)00378-2
5. Vidal, M., López-Sánchez, J. F., Sastre, J., Jiménez, G., Dagnac, T., Rubio, R., & Rauret, G. (1999). Prediction of the impact of the Aznalcóllar toxic spill on the trace element contamination of agricultural soils. Science of the Total Environment, 242(1-3), 131-148. doi.org/10.1016/S0048-9697(99)00380-0
6. Madejón, P., Murillo, J. M., Marañón, T., Cabrera, F., & López, R. (2002). Bioaccumulation of As, Cd, Cu, Fe and Pb in wild grasses affected by the Aznalcóllar mine spill (SW Spain). Science of the Total Environment, 290(1-3), 105-120. doi.org/10.1016/S0048-9697(01)01070-1
7. Ötvös, E., Pazmandi, T., & Tuba, Z. (2003). First national survey of atmospheric heavy metal deposition in Hungary by the analysis of mosses. Science of the Total Environment, 309(1-3), 151-160. doi.org/10.1016/S0048-9697(02)00681-2
8. Onianwa, P. C., & Adoghe, J. O. (1997). Heavy-metal content of roadside gutter sediments in Ibadan, Nigeria. Environment international, 23(6), 873-877. doi.org/10.1016/S01604120(97)00098-6
9. Wheeler, G. L., & Rolfe, G. L. (1979). The relationship between daily traffic volume and the distribution of lead in roadside soil and vegetation. Environmental Pollution (1970), 18(4), 265-274. doi.org/10.1016/0013-9327(79)90022-3
10. Agrawal, P., Mittal, A., Prakash, R., Kumar, M., Singh, T. B., & Tripathi, S. K. (2010). Assessment of contamination of soil due to heavy metals around coal fired thermal power plants at Singrauli region of India. Bulletin of Environmental Contamination and Toxicology, 85(2), 219-223. doi.org/10.1007/s00128-010-0043-8
11. Öncel, M. S., Zedef, V., & Mert, S. (2004). Lead contamination of roadside soils and plants in the highways between Istanbul and Sakarya, NW Turkey. Fresenius Environmental Bulletin, 13(12), 1525-1529.
12. Vidal, M., López-Sánchez, J. F., Sastre, J., Jiménez, G., Dagnac, T., Rubio, R., & Rauret, G. (1999). Prediction of the impact of the Aznalcóllar toxic spill on the trace element contamination of agricultural soils. Science of the Total Environment, 242(1-3), 131-148. doi.org/10.1016/S0048-9697(99)00380-0
13. Alnasur, F. S., Almansoori, A. C., AL-Furaiji, M. A., & Kareem, M. I. (2020, November). A Study of the Chemical and Physical Properties of Cane as a Biofuel After Thermal Treatment Processes (Tarification). In Journal of Physics: Conference Series (Vol. 1664, No. 1, p. 012133). IOP Publishing. doi.org/10.1088/1742-6596/1664/1/012133
14. The Ministry of Electricity, General Directorate of Electric Power Production in the Middle Euphrates, North Al Diwaniyah Diesel Station, Operation Department, unpublished data, 2017.
15. Al-Tai,A,B,. (2018). Evaluation of the spatial suitability of electric power plants in Al-Qadisiyah Governorate using GIS. Al-Qadisiyah Journal For Humanities Sciences, 21(4), 322-343.
16. Hatanpää, E., Kajander, K., Laitinen, T., Piepponen, S., & Revitzer, H. (1997). A study of trace element behavior in two modern coal-fired power plants I. Development and optimization of trace element analysis using reference materials. Fuel processing technology, 51(3), 205-217. doi.org/10.1016/S0378-3820(97)00006-4
17. Allen, S. E. (1989). Chemical analysis of ecological materials, 2nd edn London.
18. Zhang, X., Ou, X., Yang, X., Qi, T., Nam, K. M., Zhang, D., & Zhang, X. (2017). Socioeconomic burden of air pollution in China: Province-level analysis based on energy economic model. Energy Economics, 68, 478-489. doi.org/10.1016/j.eneco.2017.10.013

19. Dockerty, T., Appleton, K., & Lovett, A. (2012). Public opinion on energy crops in the landscape: considerations for the expansion of renewable energy from biomass. Journal of Environmental Planning and Management, 55(9), 1134-1158. https://doi.org/10.1080/09640568.2011.636966
20. Shanker, A. K., Cervantes, C., Loza-Tavera, H., & Avudainayagam, S. (2005). Chromium toxicity in plants. Environment international, 31(5), 739-753doi.org/10.1016/j.envint.2005.02.003
21. Alnasur, F. S., & Al-Furaiji, M. A. (2021, August). Estimation the Performance of Gas Turbine Power Station with Air Cooling Fog System. In Journal of Physics: Conference Series (Vol. 1973, No. 1, p. 012040). IOP Publishing. doi.org/10.1088/1742-6596/1973/1/012040
22. Halalsheh, M., Kassab, G., Shatanawi, K., & Al-Shareef, M. (2018). Development of Sanitation Safety Plans to Implement World Health Organization Guidelines: Jordanian Experience. In Safe Use of Wastewater in Agriculture (pp. 101-130). Springer, Cham.

*Paper submitted: 22.07.2021.*
*Paper accepted: 20.09.2021.*