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## NOISE MEASUREMENT IN THE OIL PRODUCTION AREAS, A CASE STUDY OF FULA, FULA NORTHEAST, JAKE, AND HADEEDA FIELDS, SUDAN

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*Operations and stages such as drilling and processing cause noise and vibrations resulting from the movement of heavy machinery, drilling, and machine sounds, which may negatively affect public health. This study aims to measure noise levels in the Fula, Fula Northeast, Jake, and Hadeeda fields. To achieve this aim, a field survey method was followed using noise measuring devices, in addition to relevant literature and secondary data. The study revealed high noise levels above the WHO recommended level of 85 dB, where Hadeeda field recorded 105, Fula 95 dB, Pumping Station3 92 dB, and Pumping Station4 90dB, while other sites recorded levels of 85 dB or less, which is considered acceptable and does not pose a risk to public health. The study recommends the need for continuous monitoring and evaluation of the noise status within oil fields and in the surrounding environment to enhance safety and public health.*

**Keywords:** workers, pumping stations, decibels, pipelines, environment.

### INTRODUCTION

Noise is fluctuations in air pressure that can affect the human body. The loud vibrations detected by the human ear are referred to as unwanted noise and sounds and can cause harm to a person's general health in the long term, especially for those who experience them daily [7, p.250]. Heavy industries and places of mineral and oil exploration are one of the places that can constitute a source of noise and vibrations that are sometimes beyond the tolerance level of the human ear [4], [13, p. 8].

In many African oil countries, safety and environmental measures are always ignored and the focus is on maximizing production, unlike the situation in the big oil countries such as Norway and Azerbaijan, for example [6, p. 430], Main oil companies in these countries follow stricter procedures and standards to reduce the effects of noise on public health, and they also put in place special protocols to protect workers in the oil sector from the risk of noise resulting from continuous exposure [2, p. 11].

Oil production in Sudan began in the late nineties of the last century, and the volume of production at that time reached 56 thousand barrels per day. Then the oil industry began gradually expanding with exploration and new oil fields until production reached its peak in the year 2008 at about 450 thousand barrels per day, and then it began to decline in 2011 after the independence of the state of South Sudan from Sudan and thus Sudan lost 75% of oil production. Today, Sudan produces only 60.000 per day [1, p. 24], [3, p. 80]. The expansion of the oil industry and the development of oil infrastructure have led to negative environmental impacts that have been reflected on human and animal health, especially in oil production areas. This is because the oil industry is accompanied by many environmental changes, including noise and vibrations resulting from exploration operations, the operation of machinery, and the movement of heavy machinery on the roads and others which if they exceed the reasonable limit or continue for long periods, could affect pub-



lic health [12, p. 1392]. According to many studies in the field of public health, exposure to noise and vibration can cause severe psychological and physical damage, especially to those people who are near sources that constantly emit loud sounds, and this applies to oil production areas [5, p. 6].

Public health research indicates that humans begin to be affected by noise at a level of 70 decibels, and then the effect increases with the increase in sound intensity to the point of heart attacks if the noise level is at 140 to 190 decibels [14, p. 5]. Hearing damage may be temporary or permanent, depending on the intensity and continuity of the noise, or sometimes it may lead to complete loss of hearing. On the other hand, the damage may be psychological, causing depression, nervousness, and sleep disorders, which in turn affects the person's mental abilities, for example, but not limited to [4, p. 15].

This study was conducted to determine noise levels in the -Fula, Fula Northeast (FNE), Jake and Hadeeda oil fields, in addition to the pumping stations in the pipelines, to detect noise levels and whether they are in line with the global standards permitted by the World Health Organization, which are 85 decibels for heavy industries that includes oil industry.

## MATERIAL AND METHODS

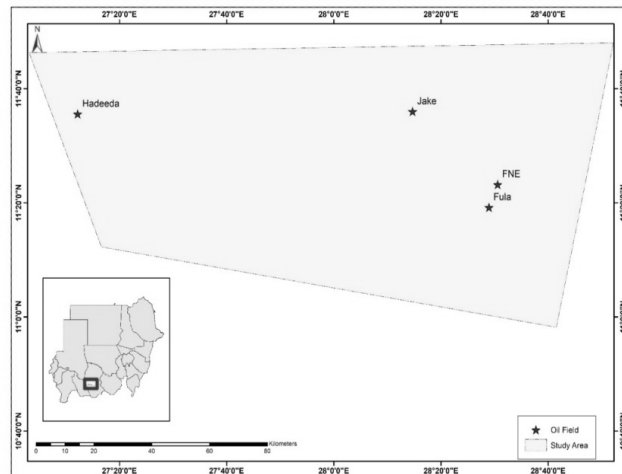
### Study aera

**Jake oilfield:** is located approximately 48km northwest of Fula oilfield (figure.1), and 30km northwest of Moga (FPF), with an average elevation of 510m above MSL. As of October 2020, Jake's total cumulative oil production was 50,883,276 STB. Gas production totaled 53,685,039 Mscf, and water totaled 88,780,999 STB. Jake oilfield well performance showed that out of 36 available wells, 15 wells are pumping, 4 wells are naturally flowing, 11 wells are shut-in for downhole problems, 2 wells are of low potential and 4 wells are of no potential [10].

**Hadeeda oilfield** is located approximately 140km northwest of Fula CPF (figure.1), and 120km northwest of Keyi FPF, with an average elevation of 470m above MSL. Its facilities have been put into production by December 2012, consisting of 22 wells, 3 OGMs and respective trunk lines, Hadeeda's crude oil is characterized by being light, As of October 2020, Hadeeda's total cumulative oil production was 10,175,553 STB. Gas production totalled 2,569,798 Mscf, and water totalled 11,143,483 STB. Hadeeda oilfield well performance showed that out of 22 available wells, 14 wells are pumping, 7 wells are shut-in for downhole problems and 1 well is of no potential [10].

**Fula Northeast (FNE)** oilfield is located 10km the northeast of Fula oilfield (figure.1), and its FPF is designed for 20,000BOPD heavy crude oil with 75% water cut. FNE's crude oil is characterized by being heavy, with an average API of (), and a large sand content (0.1% by volume max)(*Ministry of Oil and Energy*).As of October 2020, FNE's total cumulative oil production was 20,458,421 STB and water totalled 12,986,668 STB. Sand production totalled 3,884 bbl. FNE oilfield well performance showed that out of 112 available wells, 92 wells are pumping, 16 wells are shut-in for downhole problems, 2 wells are shut-in for surface problems and 2 wells are of no potential [10].

**Fula field:** is in the southern region of Sudan, 600km southwest of the capital Khartoum, 90km northeast of Muglad city and 50km south of Fula(figure.1). The CPF is in the central area of Fula North field, an area with a relatively high elevation of approximately 550m MSL. The facility was commissioned in November 2003[10]. Fula CPF was designed with a capacity of 40,000BOPD. It receives and gathers crude oil from 8 OGMs, flow lines of 5 heavy oil wells, flow-lines of 4 light oil wells and the transit line from Moga FPF [3].



**Fig. 1.** Map of Study Area

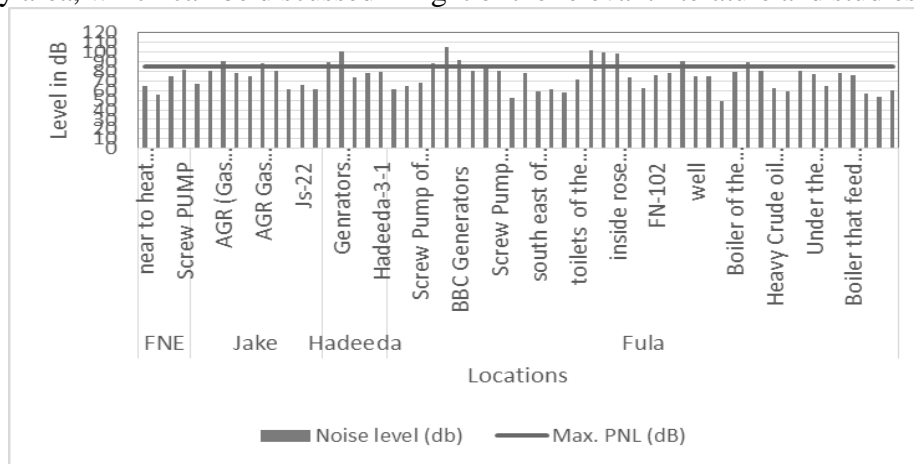
**Data collection methods**

Using noise measuring devices like Lutron. SL-4011., noise measurements were taken in workshops at operating time, when the operating condition of the machine is noisy. Additional points do not present in the baseline data were taken based on the operating condition and observations. The results of the measurements were then recorded for each field and some notes were recorded when necessary. Day and night surveys were conducted at each site. Day surveys started at 7:00 a.m. and ended at 11:30 a.m. and again at 1:00 p.m. after a short break until 5:30 p.m. Night surveys started at 7:30 p.m. and ended at 11:30 p.m.

Moreover, this study relied on the research works conducted in the world by Gadir Bayramli(2020), Aud Nistov(2012), Alshebli A. Ahmed, Mohammed A. Awadalkarim (2015), Bakhtiar, Edi Yusuf, Muhammad Reza Fahlevi (2023), and others in the field of noise. The works of Sudanese and foreign researchers also formed an important basis for this study. The researcher papers by Mustaf Abdlla (2015), Abdelrahman A Sliman and others(2022), the research works of others are considered some of the most important in the field of noise studies in oil fields.

**RESULTS AND DISCUSSION**

After conducting a field survey using noise measuring devices, varying levels of noise were detected in the study area, which can be discussed in light of the relevant literature and studies as follows:

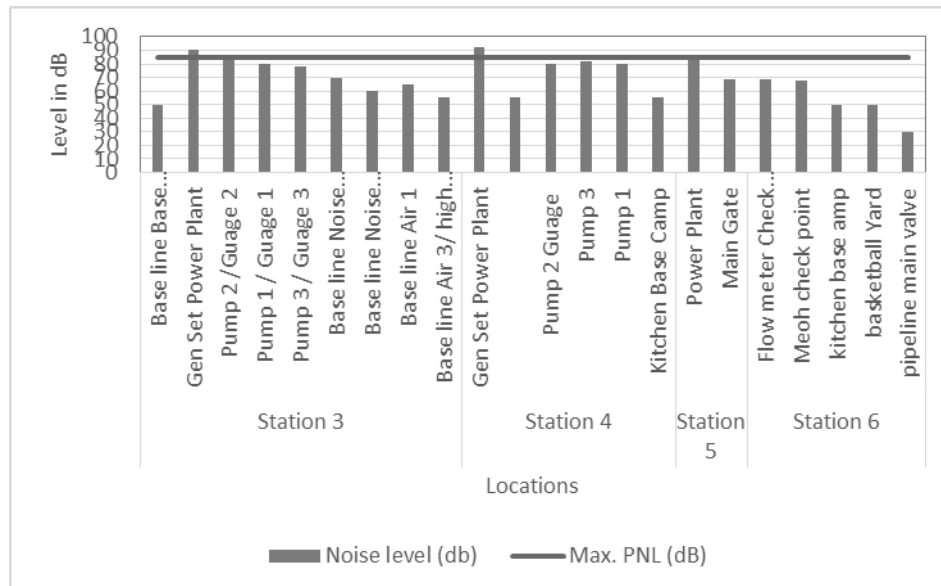


**Fig. 2.** The measured noise level compared with Maximum Permissible Noise Level at the oil fields.

**Source:** based on data from field survey,2024.



Above figure 2. indicates noise measurements conducted in oil fields, which included several sections within these fields. The measurements ranged between very high, i.e. above the permissible level, and acceptable levels. The highest noise readings were recorded in the BBC workshop, BBC generators, CPF workshop, CPF power station engines and AGR compressors with average readings of 95.5 and 81 dB which are high levels according to the WHO and other health authorities concerned with human health and could cause harm to workers in these sites in the foreseeable future although the operators reported that workers wear earplugs while working which does not eliminate the risk of noise exposure completely as Rutherford and others[14] mentioned. Elsewhere the highest noise readings were recorded in the heater, screw pump for oil tanks and AGR compressor unit with readings exceeding 90 dB for both. In another recording, noise readings were obtained in the heater and screw pump at 85 and 81 dB respectively, which are considered acceptable according to the World Health Organization standards, while the highest noise readings were recorded in the mud pump and power station unit generators at 89.7 dB and 100.6 dB respectively, which is the highest noise reading ever recorded. Ibrahim and others [8] attribute the high noise to the high operating voltage of the power stations and generators, which requires more safety precautions for workers in these sites.



**Fig. 3.** The measured noise level compared with Maximum Permissible Noise Level at the pump's stations.

**Source:** based on data from field survey, 2024.

Above Figure 3. shows the noise measurements obtained from the pumping stations, where it was found that all noise measurements were at an acceptable level except for some locations that were higher than the permissible level.

The highest value was recorded at the flow meter checkpoint with an audio reading of 69 dB, which is within the permissible level, while the highest value was detected at the power station with an audio reading of 86.4 dB, which is also within the permissible range.

The other measurement was recorded at the main gate with an audio reading of 68.4 dB, while the highest value at the generator set of the power station was detected with an audio reading of 92 dB. These measurements are consistent with what Karem and others [9,p.12] said regarding pumping stations, as they are the least recorded noise measurements compared to other sectors in the oil industry chain. However, this means neglecting safety measures to protect workers inside these stations.

**Table 1**

Summarized the minimum and maximum level of noise that were measured in oil fields and pumps stations

Parameter		FNE	Jake	Hadeed a	Fula	Station 3	Station 4	Station 5	Station 6
Noise	Min	56	62	74	49.1	50	55	68.4	30
	Max	81.7	90.6	100.6	105	90	92	86.4	69

**Source:** based on data from field survey, 2024.

Above table 1. summarizes the minimum and maximum noise levels measured, from these figures it can be noted that the lowest noise level detected was at Station 6 with a reading of 30 decibels, while the highest noise level measured was at the Fula field where it reached 105 decibels, which is above the permissible level and may pose a risk to human health.

## CONCLUSION

Based on the above and after the field survey that was conducted, it can be concluded that the noise levels are high and more than the recommended limit by the World Health Organization of 85 decibels in the fields of both Fula and Hadeeda in addition to pumping stations 3 and 4, while they were lower and within the acceptable limit in the rest of the sites that were measured and are considered normal based on their activities. Therefore, this area was considered a clean area free from noise hazards. On the other hand, the sites that recorded high noise readings may pose a risk to workers and to public health in the surrounding environment in general if the necessary safety and protection measures are not taken by oil companies to reduce the effects of noise as much as possible. Although workers in these sites are required to plug their ears during working hours, this may not be sufficient if the noise and vibrations are very high. Therefore, this study recommends the necessity of continuous monitoring and evaluation of the noise status within the oil fields and in the surrounding environment to enhance safety and public health.

## REFERENCES

1. Abuagla, Mustafa Abdalla. Republic of Sudan Ministry of Petroleum & Gas General Directorate of Environment and Safety ( GDES ), – 2015, – p. 23-26.
2. Ahmed, Alshebli A. Noise Induced Hearing Loss at Two Textile Plants in Sudan, – 2015, – p. 1399-4006.
3. Ali, Sabna. “Oil, Export Diversification and Economic Growth in Sudan: Evidence from a VAR Model. // Mineral Economics, – 2023, 36 (1), – p. 77-96.
4. Alzamzam, Wahid Salem, and Walid Bashir Alfaghi. “Noise Evaluation in Oil and Gas Fields and Associated Risk Assessment.” Euro-Mediterranean Journal for Environmental Integration, – 2021.
5. Bakhtiar. “Analysis of Noise Measurements in the Work Area To the Operator’S Hearing in the Process Department Using the Work Sampling Method.” Multica Science and Technology (Mst) Journal, – 2023, 3 (1), – p. 136-141.
6. Bayramli, Gadir. “The Environmental Problems of Azerbaijan and the Search for Solutions.” // WSEAS Transactions on Environment and Development, – 2020, 16, – p. 423-433.
7. Garang Kuch, Simon, and Jean Pierre Bavumiragira. “Impacts of Crude Oil Exploration and Pro-



duction on Environment and Its Implications on Human Health: South Sudan Review.” // International Journal of Scientific and Research Publications (IJSRP), – 2019, 9 (4), – p. 8836.

8. Ibrahim, S. Estimates of Mycobacterial Infections Based on Abattoir Surveillance in Two North-Eastern States of Nigeria, – 2018

9. Karem, Duha S. “Study the Air Pollution in West Qurna-2 Oil Field Southern Iraq.”// Journal of Pharmaceutical, Chemical and Biological Sciences, – 2016, 4 (3), – p. 416-430.

10. Ministry of Energy and Petroleum. Annual report, .Ministry of Energy and Petroleum, Sudan, 2023, [www.mop.gov.sd/](http://www.mop.gov.sd/)

11. Nistov, Aud. Paper No. SPE-156848-PP Noise Reduction Interventions in the Norwegian Petroleum Industry.

12. Oguntunde, Pelumi E. “A Study of Noise Pollution Measurements and Possible Effects on Public Health in Ota Metropolis, Nigeria.” // Open Access Macedonian Journal of Medical Sciences, – 7 (8), – p. 1391-1395.

13. Rosa, Patricia, and Nicola Koper. “Impacts of Oil Well Drilling and Operating Noise on Abundance and Productivity of Grassland Songbirds.” // Journal of Applied Ecology, – 2022, 59 (2), – p. 574-584.

14. <https://doi.org/10.3133/sir20235114>.

15. Sliman, Abdelrahman A. “Noise Exposure among Traffic Police Officers in Khartoum Locality, Sudan.” // European Scientific Journal, – 2015, 11 (6), – p. 1857-7881.

## NEFT HASİLATI RAYONLARINDA SƏS SƏVIYYƏSİNİN ÖLÇÜLMƏSİ: SUDANDIN FULA, FULA ŞİMAL-ŞƏRQ, CEYK VƏ HADİDƏ YATAQLARININ TƏDQIQATI

**Adəm Əbdülsəməd**

Qazma və emal kimi işlər və mərhələlər ağır avadanlıqların hərəkəti, qazma və maşınların səs-küyü nəticəsində yaranan və ictimai sağlamlığa mənfi təsir göstərə bilən səs və vibrasiya yaradır. Bu tədqiqatın məqsədi Fula, Fula Şimal-Şərq, Ceyk və Hadidə yataqlarında səs səviyyəsini ölçməkdir. Bu məqsədə nail olmaq üçün səs səviyyəsini ölçən alətlərdən istifadə etməklə səhra tədqiqatı metodundan, həmçinin müvafiq ədəbiyyat və ikinci dərəcəli məlumatlardan istifadə edilmişdir. Tədqiqat ÜST-nin tövsiyə etdiyi 85 dB səviyyəsini keçən yüksək səs səviyyələrini aşkar etdi: belə ki, Hadidə yatağında 105 dB, Fulada 95 dB, 3-cü nasos stansiyasında 92 dB və 4-cü nasos stansiyasında 90 dB, qalan sahələrdə isə 85 dB və ondan aşağı səviyyələr qeydə alınıb, bu da məqbul hesab edilir və ictimai sağlamlıq üçün təhlükə yaratmır. Tədqiqat ictimai təhlükəsizliyin və sağlamlığın yaxşılaşdırılması üçün neft yataqlarında və ətraf mühitdə səs-küy şəraitinin davamlı monitorinqi və qiymətləndirilməsinin aparılmasını tövsiyə edir.

**Açar sözlər:** *işçilər, nasos stansiyası, desibellər, boru kəmərləri, mühit.*





## ИЗМЕРЕНИЕ ШУМА В РАЙОНАХ ДОБЫЧИ НЕФТИ: ИССЛЕДОВАНИЕ МЕСТОРОЖДЕНИЙ ФУЛА, ФУЛА СЕВЕРО-ВОСТОК, ДЖЕЙК И ХАДИДА В СУДАНЕ

Адам Абдельсамед

Такие работы и этапы, как бурение и переработка, вызывают шум и вибрации, возникающие в результате движения тяжелой техники, бурения и шума машин, которые могут отрицательно влиять на здоровье населения. Целью данного исследования является измерение уровней шума на месторождениях Фула, Фула северо-восток, Джейк и Хадида. Для достижения этой цели использовался метод полевого исследования с использованием приборов для измерения шума, а также соответствующая литература и вторичные данные. Исследование выявило высокие уровни шума, превышающие рекомендуемый ВОЗ уровень в 85 дБ: так, на месторождении Хадида было зафиксировано 105 дБ, на Фуле — 95 дБ, на 3-й насосной станции — 92 дБ и на 4-й насосной станции — 90 дБ, в то время как на остальных участках были зафиксированы уровни 85 дБ и ниже, что считается приемлемым и не представляет риска для здоровья населения. Исследование напоминает о необходимости постоянного мониторинга и оценки состояния шума на нефтяных месторождениях и в окружающей среде для повышения безопасности и здоровья населения.

**Ключевые слова:** Рабочие, насосные станции, децибелы, трубопроводы, среда.