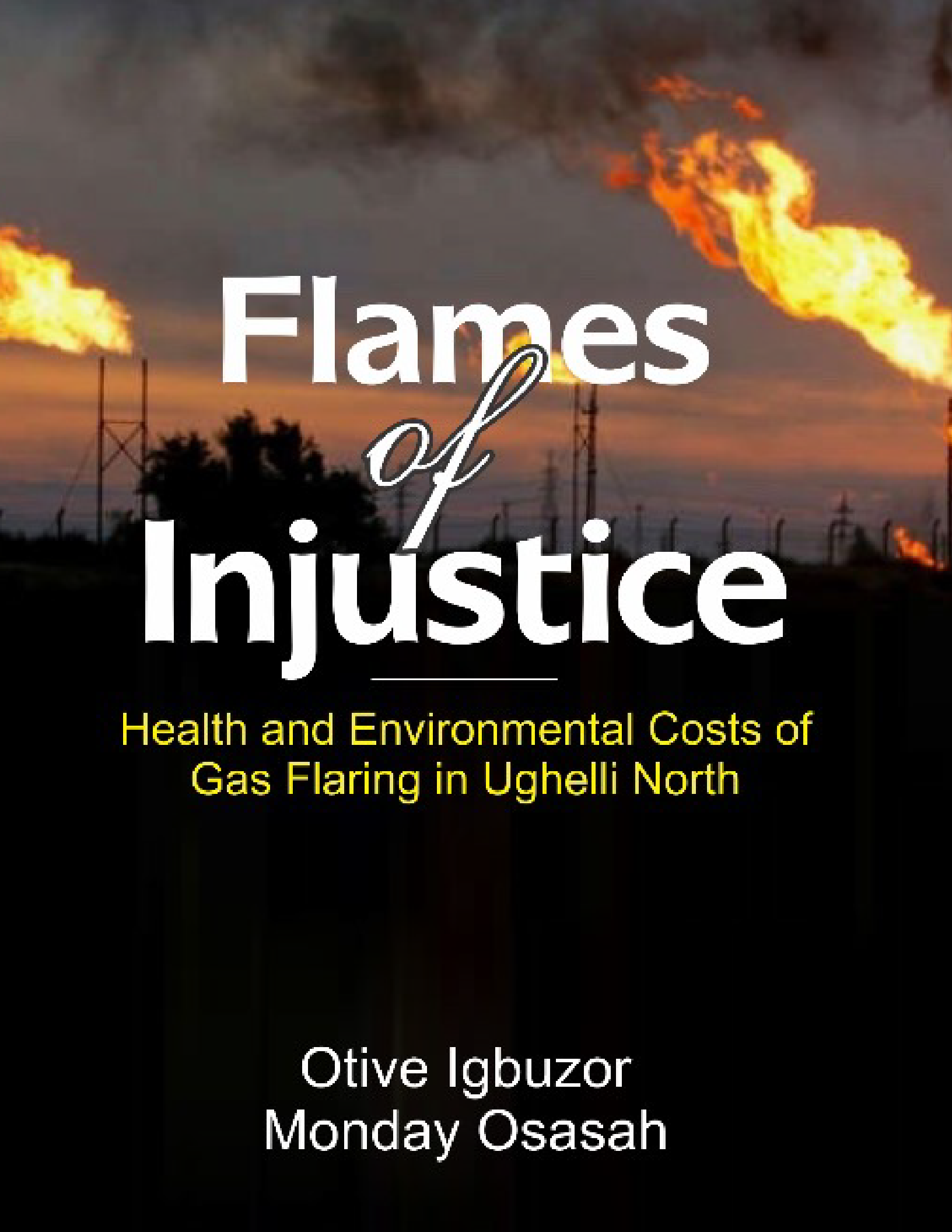

Flames of Injustice

Health and Environmental Costs of Gas Flaring in Ughelli North

Otive Igbuzor
Monday Osasah

FLAMES OF INJUSTICE:
HEALTH AND ENVIRONMENTAL COSTS OF GAS FLARING IN UGHELLI NORTH

FLAMES OF INJUSTICE:
HEALTH AND ENVIRONMENTAL COSTS OF GAS FLARING IN UGHELLI NORTH

Otive Igbuzor

Monday Osasah

KRAFT BOOKS LIMITED

Published by

Kraft Books Limited
11A Ojo'badan Avenue, Off Osuntokun Avenue,
Old Bodija, Ibadan
Box 22084, University of Ibadan Post Office
Ibadan, Oyo State, Nigeria
✆ +234(0)803 348 2474, +234(0)805 129 1191
+234 (0)803 350 9421, +234 (0)905 723 9357
E-mail: kraftbooks@yahoo.com;
kraftbookslimited@gmail.com
@ Kraftbooks limited
@Kraft_books

First published 2025

ISBN 978–978–918–906–9

First printing, June 2025

DEDICATION

This book is dedicated to all those who have suffered the catastrophic effects of gas flaring in Nigeria.

ACKNOWLEDGEMENTS

The Ejiro & Otive Igbuzor Foundation extends its deepest gratitude to the following individuals and organizations for their invaluable contributions to the research on gas flaring in Ughelli North LGA, Delta State, and the development of this book.

Our special thanks go to Global Green Grants Fund for their generous support and funding of the project "Advocacy Against Gas Flaring in Ughelli North LGA of Delta State", without which, the project would not have been possible. We also appreciate the research team led by Prof. Sunny Awhefeada for their tireless efforts in conducting the research and compiling the report, highlighting critical issues surrounding gas flaring, and providing a foundation for advocacy and action.

To the participants from Ughelli North LGA and other adjoining LGAs who actively engaged during the research validation and sensitization workshop held at the Delta State University, we are grateful for your invaluable insights and perspectives. Our gratitude also goes to the university for providing the necessary facilities that enabled the smooth execution of the workshop, and to stakeholders from government, industry, and civil society who participated in the workshop and offered their expertise and recommendations. Your involvement underscores the importance of a multi-stakeholder approach in addressing the complex challenges posed by gas flaring.

To the people and communities in Ughelli North LGA, we express our deepest respect and admiration for your resilience in the face of environmental adversity. The cooperation you extended to the research team and your

determination to seek solutions to improve your living conditions are a huge source of inspiration to us all.

Finally, we thank the management of the Foundation, including the President, Dr. Otive Igbuzor, the Vice President, Dr(Mrs) Ejiro Otive-Igbuzor, the Executive Director, Mr. Monday Osasah, and other secretariat staff for their contributions and support in shaping the project and work.

We hope this book will inspire collective action to mitigate the effects of gas flaring and promote a more sustainable future for the people of Ughelli North and beyond.

PREFACE

As we navigate the complexities of environmental sustainability and community development, gas flaring remains a pressing concern, particularly in oil-producing local governments like the Ughelli North Local Government Area of Delta State, Nigeria. The Ejiro & Otive Igbuzor Foundation, a non-profit and non-governmental organization dedicated to promoting community development, women's empowerment, education, and leadership, has taken a stance on addressing this challenge.

The practice of gas flaring has far-reaching consequences, including air pollution, CO2 emissions, acid rain, and the degradation of agricultural land. These effects not only harm the environment but also impact the livelihoods of local communities, particularly women who depend on agriculture and natural resources for their sustenance. Research conducted by our Foundation highlights the urgent need for collective action to mitigate the effects of gas flaring and promote sustainable development.

Through the project "Advocacy Against Gas Flaring in Ughelli North LGA of Delta State," supported by Global Green Grants Fund, we aim to enlighten the local population about the harmful effects of gas flaring and advocate for its cessation. This book is a culmination of research and sensitization efforts, providing insights into the devastating impact of gas flaring on the environment, biodiversity, and livelihoods in the local government.

The book is divided into several sections, each addressing a critical aspect of gas flaring and its effects. We explore the environmental impacts, including the destruction of biodiversity and the pollution of water bodies, as well as the social impacts, such as the loss of agricultural land and the

exacerbation of poverty among women. We also examine the economic implications of gas flaring, including the loss of potential revenue and the costs of environmental degradation.

Our research underscores the importance of adopting sustainable practices in the oil and gas industry, including the utilization of natural gas and the reduction of greenhouse gas emissions. We believe that by working together, we can create a more sustainable and equitable future for the people of Ughelli North and beyond.

As we move forward, we must prioritize sustainability and environmental responsibility in our efforts to develop and utilize our natural resources. This requires a collaborative approach, involving government, industry stakeholders, and local communities. By working together, we can ensure that the benefits of oil exploitation are balanced with environmental sustainability and social responsibility.

This book serves as a call to action, providing insights and recommendations for policymakers, industry stakeholders, and community leaders. We hope that it will contribute to a broader understanding of the issues surrounding gas flaring and inspire collective action to address this critical challenge. Through advocacy, education, and community engagement, we can work towards a future where gas flaring is a thing of the past, and our environment is protected for generations to come.

Monday Osasah
Executive Director,
Ejiro & Otive Igbuzor Foundation

FOREWORD

The story of gas flaring in Nigeria, particularly in the Niger Delta, is a tale of environmental degradation, systemic neglect, injustice, and the silent suffering of communities long overlooked in the corridors of power and profit. This book presents a comprehensive and deeply personal inquiry into one of the most pressing environmental and human rights issues of our time.

My passion for environmental justice is deeply rooted in personal experience. I grew up in Ugono-Orogun in Ughelli North Local Government Area of Delta State, where gas flaring was a nightly spectacle. The gas flares from Erhoike lit up our skies and made the night look like day. As children, we admired the brightness. But as we grew older, we began to understand the cost—the poisoned air, degraded land, health complications, and the destruction of livelihoods and ecosystems. What once appeared magical was, in fact, harmful and unjust.

This work is a culmination of years of personal experience, scholarly inquiry, and grassroots engagement. With the support of the Global Greengrants Fund and in partnership with committed researchers and advocates like Prof. Sunny Awhefeada and long-time environmental advocates like Arc. Nnimmo Bassey, we have undertaken not only to document the lived realities of affected communities such as Orogun, Evwrerni, Ogor, and Eruemukohwoarien, but also to amplify their voices and push for meaningful, data-driven change.

Gas flaring is more than an environmental issue—it is a violation of human rights. It destroys the health of communities, renders farmland infertile, depletes biodiversity, and exacerbates the already severe socioeconomic vulnerabilities of women and children. For

decades, oil companies have operated with impunity, prioritizing profits over people, while the state has often looked away.

This book is both a research report and a call to action. It offers evidence-based analyses while making an urgent moral case for ending gas flaring. It challenges us to confront uncomfortable truths, and to move beyond awareness to advocacy and from advocacy to transformation. At its heart, it is a call for justice—environmental, economic, and social.

I am profoundly grateful to all those who contributed to this work—our community leaders, civil society organizations, academic collaborators, and government partners. Your courage and commitment give me hope that we can indeed end the scourge of gas flaring and build a future where the people of the Niger Delta can live in dignity, breathe clean air, and enjoy sustainable development. It is only through collective effort and shared responsibility that we can begin to reverse the decades of environmental injustice and pave the way for a healthier, more equitable future.

Let this book serve as a renewed call to conscience. Let us unite to end gas flaring, restore our environment, and uphold the rights and dignity of all people—especially those in the Niger Delta who have endured so much for so long.

Let us work together to protect our environment, defend our communities, and leave a legacy of justice and restoration.

Otive Igbuzor, PhD
President, the Ejiro & Otive Igbuzor Foundation
June 2025

CONTENTS

CHAPTER

1

SURVEY OF GAS FLARING IN UGHELLI NORTH LOCAL GOVERNMENT AREA OF DELTA STATE

Professor Sunny Awhefeada

Gas Flaring at Erhoike (Kokori/Orogun Field)
23rd May, 2025

Executive Summary

The present study is an advocacy intervention that seeks to offer preventive mechanisms and remedial strategies against gas flaring in Ughelli North Local Government Area of Delta State. The area understudy is made up of seven clans or kingdoms six of which are oil producing. These are Agbarha-Otor, Evwreni, Ogor, Orogun, Ughelli and Uwheru.

The experience of gas flaring in the area has been on for more than sixty years starting with Shell Petroleum Development Company and later Heritage Energy Operational Services Limited. The area understudy is located in the OML 30 assets. In Agbarha-Otor, the Eriemu Field encompasses Owenvwe, Omavovwe and Opherin; Evwreni Field includes Unenurhie and Uwheru; Afiesere Field is made up of Afiesere and Ofuoma; Erhuemukohwarien Field includes Ekiugbo and Ododegho; Orogun and Awhire are under Kokori/Orogun Field; and Usioka Field at Ejekota. First Hydrocarbon Nigeria Company Limited which is dominant in the Isoko area has pipelines which run through Ughelli North with a manifold at Gana junction in Agbarha-Otor from where the crude is carried to Escravos terminal.

In this study, the host communities where crude oil exploration takes place are not only identified, but the devastating consequences are evaluated. Interviews/informal discussions were conducted with indigenes and workers of the oil company who were reluctant to speak. The views garnered from the discussions indicate that the dwellers are aware of the devastating changes gas flaring has wrought on their communities. The scientific literature on gas flaring globally and locally also revealed the deadly essence of gas flaring. Matching the views of the people, the workers of the oil company and the extant literature on gas flaring, this study is able to deduce the grave dangers of gas flaring to the host communities.

Having explored the dangers, the study offers insights into strategies that are both preventive and remedial in combating the menace of gas flaring in Ughelli North Local Government Area. The overall goal is for this study and its recommendations to form an advocacy tool that will reduce or eradicate gas flaring in line with global and national regulations in order to humanize the communities affected.

Introduction

Gas flaring is a global menace in places where crude oil is exploited. In the last three decades, a lot of attention has been drawn to the multiple ills associated with this phenomenon. Gas flaring poses great dangers to humanity as it not only alters the global ecosystem, it has also precipitated climate change which in itself has become a threat of global proportions. Other frightening consequences of gas flaring include pollution, loss of biodiversity, loss of livelihood, decrease in food production, social disruption, poverty, disease and death. In view of the threats of gas flaring manifesting in ecocide, the world came to enact regulations and laws aimed at remedying the menace. There are many legal frameworks that are intended to regulate gas flaring and curb its nuisance. There have also been scientific researches aimed at preventing and offering remediation to the crisis. In this study, attempt is made to focus on gas flaring in Ughelli North Local Government Area of Delta State in Nigeria with a view to mounting an advocacy against this enemy of humanity.

Objectives

The primary objectives of the research and survey are to:

1. Assess the extent and impact of gas flaring on the environment, health, and socio-economic conditions of the communities in Ughelli North.

2. Identify the key stakeholders involved in gas flaring activities and their roles.
3. Investigate the legal and policy framework governing gas flaring in Nigeria, including the implementation of the Petroleum Industry Act and the Host Community Trust Fund.
4. Evaluate community awareness and perceptions regarding gas flaring and their coping mechanisms.
5. Develop an advocacy brief based on research findings to inform policy engagement and community sensitization.

Scope

The research and survey will cover the following key areas:

- **Environmental Impact:** Literature review of air, soil, and water pollution due to gas flaring, including acid rain and biodiversity loss.
- **Health Impact:** Literature review of respiratory diseases, skin conditions, and other health issues linked to gas flaring.
- **Economic Impact:** Examination of the loss of agricultural productivity, fishing activities, and other livelihood sources.
- **Policy and Regulatory Review:** Analysis of existing policies on gas flaring and their enforcement.
- **Community Engagement:** Collection of qualitative and quantitative data from affected communities through surveys, interviews, and focus group discussions.
- **Stakeholder Mapping:** Identification of oil companies, government agencies, civil society organizations, and community leaders involved in the issue.

Methodology

This study evolved from a number of interventions ranging from interviews, observations and review of related literature. Interventions by experts in environmental sciences and public health also strengthened the study. Stakeholders who are indigenes of host communities, the oil company, NGOs and CSOs offered perspectives that were analyzed. An interactive seminar/workshop involving stakeholders was also convened to subject the findings and other related issues to critical analysis. Data involving pictorial depictions are also deployed in the study. However, officials of the oil company and Community Liaison Officers were unwilling to volunteer information. A small informal group discussion was also held to review the perspectives/opinions of the stakeholders spoken to in the host communities.

Literature Review

Crude oil exploration and exploitation began in Urhoboland around 1959 just three years after Oloibiri where the phenomenon started in 1956. According to Darah (1998), Shell-BP was the first oil multinational to prospect and drill crude oil in Urhoboland. He further added that "within ten years, nearly all of Urhoboland became a treasure trove for Shell and other members of the oil "Seven Sisters" (56). Salutary as the discovery of crude oil was, it did come with problems that have plagued the Niger Delta region and Urhoboland in particular. The associated problems were identified many years ago and they persist till this day. Egborge (1998) highlights the environmental crisis occasioned by oil and gas exploration not just in Urhoboland, but in the Niger Delta. Onosode (1998) also noted conflicts which are of "environmental concerns" which largely derive from oil and gas exploration.

Beyond the foregoing, there are studies which evaluated

the experience of gas flaring in Ughelli North LGA. These studies varied as they are highlight the challenges or better put the dangers confronting the people and environment of oil producing and gas flaring communities. Studies such as Emumedjaye (2012), Ovuakporaye (2016) and Agboje, et al (2023) are among research endeavours which underscore the challeneges faced by such communities in Ughelli North. Among the problems the studies identified are health challenges, air, land and water pollution. What these studies point to is a total assault on the overall wellbeing of the people dwelling in an endangered environment.

An evaluation of these problems will throw up gas flaring as a major issue plaguing the Niger Delta and in this instance the host communities in Ughelli North LGA. Gas flaring, according to Aigbe, et al (2023), "involves piping excess gas to a remote (elevated) location and burning the gas in the open air". In their submission, Buzouc-Guven and Harriss (2014) asserted that "flaring often occurs due to lack of economic, regulatory or technical barriers to developing gas markets and gas infrastructure or when it is not feasible to re-inject associated gas back into the reservoir." This claim had earlier been made by Elvidge et al (2009). The raison de tre for flaring albeit dubious can be gleaned from Aigbe, et al's (2023) that "flaring of natural gas is common in oil and gas extractive industries, to relieve pressure within pipelines reducing explosion risk, reduce volatile organic compounds through combustion or release waste products from chemical production process". In view of what has been adduced as the cause of gas flaring it can be said that the phenomenon which has become harmful to man and environment was intended as a means of preventing disruptive accident in the oil and gas industry.

It seems that gas flaring will for a long time be the order of the day in Nigeria and by implication in Urhoboland and

Ughelli North LGA. This is so as a result of the huge quantity of gas reserves and the reality that the oil and gas sector is Nigeria's prime foreign exchange and revenue earner. Nigeria has 37.0 billion barrels of proven crude oil and about 190.4 trillion cubic feet of proven natural gas reserves (Oladele and Abdul-Azeez, 2013; Uwakonye, et al, 2006).

The harm done by gas flaring is not only injurious to human health and the environment, but it is also a major means of revenue loss as Nigeria loses an estimated $18 million dollars from flaring daily which is a quantity that could power the electricity of the United Kingdom in two years, Aigbe, et al (2023). Nigeria is among the top seven nations that flared the most gas in the world.

The harm done by gas flaring has received attention in different studies. The dangers are human and environmental and they pose a grave threat to humanity. Attesting to the threats of gas flaring, Deinye, et al (2023) affirmed that the phenomenon causes alteration of "ionic components, pH, temperature, heavy metal concentration in rain water causing death of aquatic life, extinction of fish species, health hazards, cancer, neurological, reproductive and developmental". There is also serious decrease in soil quality, reduction in vegetation growth and farm yield with negative consequences for biodiversity. In a similar evaluation of the consequences of gas flaring Nwafor (2022) identifies the many problems arising from it including hypertension, respiratory problems and an unstable ecosystem. Ologunorisa (2001) ascribes deformities in children, liver damage, skin disease and other allied problems in the host communities to gas flaring. The foregoing health risks are also emphasized in Nwosisi, et al, (2021). All of these manifestations are summed up in its harmful consequences for health and livelihood as Ojameruaye (2022) argued.

The overarching impact of gas flaring is well articulated

in Nyerovwo and Ntukogu (2020) as contaminating the air and polluting the land. The destruction of the mangrove swamps is also identified as an important negative impact by Sambo (2020), while Odega (2020) mentions how gas flaring reinforces climate change. The foregoing informed opinions and others not accounted for here attest to the multiplicity of risks and dangers associated with gas flaring.

A question arising from the above is why has gas flaring persisted despite the life threatening dangers associated with the phenomenon? The major reason is the humungous amount of money associated with oil and gas production and that money is what sustains the Nigerian economy and a substantial section of the global economy. There is also the problem of unwillingness of oil companies to comply with regulatory laws and successive governments have also not enforced the laws.

Safeguards/Measures Against Gas Flaring

Rampart and deadly as gas flaring is, are there no regulations or laws aimed at eradicating or curbing it? There are laws and regulations, but these have been observed in breach. Gas flaring was declared illegal in 1984. To begin with, the 1999 Nigerian constitution must have had the menace of gas flaring in focus when it says in Section 20, "the State shall protect and improve the environment and safeguard the water, air, land and forest wildlife of Nigeria". The components mentioned in the excerpt represent the primary targets of the unmitigated consequences of gas flaring. The need to avert, mitigate or curb the envisaged menace of gas flaring attests to the enactment of that legislation.

In line with the need for the kind of holistic legislation that will safeguard the host community from the ravages of gas flaring the Petroleum Industry Act (PIA) 2021 robustly offered several interventions that should remedy the

problem if well implemented. Section 102 focuses of "Environmental Management"; Section 103 is "Financial contribution for remediation of environmental damages"; Section 104 is "Gas Flaring penalties"; Section 105 is "Prohibition of Gas Flaring"; Section 106 is "Measurement of Flared Natural Gas"; Section 107 is "Exemptions"; while Section 108 is "Natural Gas Flare Elimination Plan". An evaluation of the different sections will reveal a deliberate attempt to not only curb and remedy, but to also eradicate gas flaring.

In addition to the safeguards in the 1999 constitution and the PIA, there are federal government's ministries, departments and agencies (MDAs) that are saddled with the responsibility of combating gas flaring and its consequences. The Federal Ministry of Petroleum Resources and the Federal Ministry of Environment are two of such leading bodies. While the former Department of Petroleum Resources (DPR) now Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigeria National Petroleum Company Limited (NNPCL) function under the Petroleum ministry, the National Environmental Standards and Regulatory Enforcement Agency (NESREA) is of the Environment ministry.

Nigeria is also a signatory to international agreements geared towards eradicating or remedying gas flaring. Among these is the Paris Climate Change Agreement of 2017 which secured a global commitment to keeping warming levels below 1.5*C, an idea that is also encapsulated in the United Nations Framework Convention on Climate Change (UNFCCC 2021). Nigeria also aligned with the Global Gas Flaring Reduction (GGFR) Initiative of 2018 which seeks to end the menace of gas flaring by 2030.

It must be said that Nigeria loses eighteen million dollars daily to gas flaring. To curb this wastage, the Nigerian Gas

Flare Commercialization Programme (NGFCP) was inaugurated to eliminate gas flaring and in the process accrue more revenue for the nation. Nevertheless, despite the foregoing gas flaring is going on unabated.

Findings

The study areas are as follows: In Agbarha-Otor, the Eriemu Filed covers Owenvwe, Omavovwe and Opherin; Evwreni Field includes Unenurhie and Uwheru; Afiesere Field is made up of Afiesere and Ofuoma; Erhuemukohwarien Field includes Ekiugbo and Ododegho; Orogun and Awhire are under Kokori Field; and Usioka Field at Ejekota. What was observed is that some of the flares have become irregular, while some remain constant.

i. Awareness

The host communities have become aware of the dangers posed by gas flaring unlike in time past when they celebrated the act and not only dried tapioca and other items by the fire, but saw the flame as an alternative to electricity that lit up their nights. They have become conscious of the challenges and dangers occasioned by it and have been lamenting.

ii. Loss of biodiversity

The villagers complain about loss of biodiversity, especially the flora and fauna. The environment has been drastically degraded. The soil quality according to them has decreased and the shrubs are no longer lush as they once were. They talk about plants/herbs species that have become extinct. This has seriously affected traditional medicine practice. It also has dire consequences for agricultural production as the soil is losing fertility. They complain about decreasing yield in okra, pepper, cassava, maize, cocoyam and other

food crops that sustained the communities in time past. They also lament about birds and animal species that are no longer within sight due to gas flaring that altered the habitat and make the place uninhabitable for them. They mention near total loss of birds like the parrot, hawk, woodpecker, canary, okan, apiapia, etc. There is a spiritual aspect to this are some animal totems that find the environment uninhabitable have left the areas. Examples are snails, antelopes, civet cats, cane rats, porcupine, rabbit, fox, monkey, etc. Fruit trees are also affected. The palm trees in such communities have lost their regal and solid green appearance. Others like mango, oranges, pear, cashew, etc, experience low yield. There is a spiritual effect in the fate of the trees like okpagha, okpobrisi and uloho that are totemic, but now badly affected by gas flaring .Local worshippers who see such trees as totems are in fear of losing them.

iii. Unusual and strange experience/unstable seasons

The nearer the community is to the flare sight the more telling the effects become. The air is hot and dense. They complain of noise generated by the flares at night and the attendant high temperatures that deprive them of sleep. They also talk about unstable climate conditions as the rains, dry season and harmattan have become unpredictable. This has affected agricultural practices.

iv. Socio-economic and health challenges

The foregoing has negative socio-economic and health impacts. Economically, the host communities are suffering from socio-economic disruption. The pollution of land and air has robbed them of robust farm yields. Since these are largely rural communities, farming remains their mainstay

but this is already threatened. Loss of means of livelihood means poverty with attendant socio-economic disruptions.

Allied to poverty induced by socio-economic dislocation is the problem of health crisis. The flare emits smoke and contains chemicals that are inimical to human beings. Dangerous phenomena such as carbon dioxide, methane, sulphur dioxide and other harmful volatile organic compounds are known to be associated with gas flaring. The people complain of strange health conditions that were unknown to them many years ago. Different kinds of skin diseases, respiratory ailments, cancer and others are among what the indigenes mentioned as the order of the day.

v. Lack of Advocacy

So far there has not been any strong advocacy that should mitigate the plight of the host communities. What has been on ground is mere symbolic engagements of Community Liaison Officers (CLOs) and occasional interactions with community heads, women and youths. These have not been enough and they are not properly guided or channeled. That is why there are frequent protests and regular shutdown of Heritage office by host communities.

Advocacy Recommendations

i. Steps should be taken by relevant stakeholders such as NGOs, CSOs and the locals to compel the Federal Government to implement regulatory laws that can end gas flaring by the 2030 deadline.

ii. The same stakeholders mentioned above should ensure that the Federal Government and the oil company embark on serious attempts at environmental remediation in order to give a new lease of life to the affected areas.

iii. Governments at all levels, the oil company and relevant stakeholders (host communities, NGOs and CSOs) should put modalities in place to ensure that all international agreements and protocols towards reducing or eradicating gas flaring are adhered to.

iv. A synergetic relationship involving government, oil company and host communities should be encouraged for them to be partners in progress.

v. A system of environmental monitoring, surveillance and whistleblowing should be put in place also by the relevant stakeholders.

vi. There should be more concerted research on public health and the environment.

vii. Rebottling of gas for domestic use in order to reduce flaring should be encouraged.

viii. There should be more research on ecology, vegetation, soil condition, climate-smart agriculture, ecosystem based mitigation among others related to the environment.

ix. The stakeholders should institute an annual evaluation strategy that should monitor the application of global best practices as they concern gas flaring.

x. A specialized clinic that will attend to ailments caused by gas flaring should be established in the area.

xi. A deliberate attempt should be made to use education and the creative arts (fine arts and drama) to enlighten the inhabitants of the areas from a young age. This will enable them know the stark reality of the inherent dangers involved and offer them insights into how to mitigate it.

Conclusion

This survey focusing on gas flaring in Ughelli North LGA of Delta State offers an insight into the prevailing circumstances of the phenomenon. The study evaluated the trajectory of gas flaring in the focus area and offered ways out of what is apparently a challenge to man and the environment. The dangers are real and already manifesting. The recommendations which should be useful to stakeholders should hopefully ameliorate the condition if followed through.

References

Agboje, I. *et al*. (2023) Effect of Crude Oil Exploration on The Availability of Non-Timber Forest Products in Ughelli North Local Government Area, Delta State, Nigeria. Ethiopian Journal of Environmental Studies & Management. 16(3): 304 – 320.

Aigbe, G. O. et, al. (2023). "Gas Flaring in Nigeria: A Multilateral Governance and Policy Coherence Analysis", *Anthropocene Science* vol. 2, 2023, pp.31-47

Buzcu-Guven, B. and Harriss, R. (2014). "Extent, Impacts and Remedies of Global Gas Flaring and Venting" *Carbon Management*, 3(1), pp. 95-108

Darah, G. G. (1998). "Social and Cultural Issues in the Exploration and Exploitation of Oil", *Proceedings of the Ist Urhobo Economic Summit '98*, Urhobo Foundation.

Deinye, H. et al. (2023). "Gas laring-induced Impacts on Aquatic Resources in the Niger-Delta Region, Nigeria", *Journal of Aquatic Science*. Vol. 38, No. 1

Egborge, A. (1998). "Environment and Sustainable Development", *Proceedings of Ist Urhobo Economic Summit '98*, Urhobo Foundation.

Elvidge, C. D. et, al. (2009). "Improving Satellite Data Estimation of Gas Flaring Volumes Year Two Final Report to GGFR". http://www.mdpi.com/1996-1073

Emumejaye, K. (2012). Investigation of the Effects of Using Gas Flare to Dry Tapioca (kpokpo-Garri) at Gana Flow-Station in Agbarha. Delta State, Nigeria. IOSR Journal of Applied Physics vol. 2(5): 6-10.

Nwafor, J. "Gas Flaring in the Niger Delta, Harmony, Health, Climate and Environment", *Nigerian Tribune*, 11th October, 2022

Nwosisi, M. C. (2021)" Spatial Patterns of Gas Flaring Stations and the Risk to Respiratory and Thermal Health of Residents of the Niger Delta, Nigeria", *Scientific African*. Vol. 12.

Odeigah, T. N. "Crude Oil Exploration and Its Ecological Impact on the Indigenous Economy of the Eastern Niger Delta Region of Nigeria", *History and the Niger Delta:* Oil, Politics and Culture (Festschrift in Honour of Professor Samuel Ovuete *Aghalino)* Eds. C. C.C. Osakwe and L. E. Odeh. Kaduna: Nigerian Defence Academy, 2020.

Ojameruaye, E. (2022). "Oil and Gas Exploration: History, Environmental and Socio-Economic Issues". *The Urhobo People of Udu and Ughievwen*, Ed. Onoawarie Edevbie. UHS Monograph # 6.

Oladele, R and Abdul-Azeez, (2013) "Revenue Generation and Transparency in Nigerian Oil and Gas Industry", *Research Journal of Finance and Accounting*, vol. 4, issue 6 (online).

Ologunorisa, T. E. (2001). "A Review of the Effects of Gas Flaring on the Niger Delta Environment", *International Journal of Sustainable Development and World Ecology*.Vol. 8, issue 3.

Onosode. G. (1998). "Reflections on Forty Years of Oil and Gas in Nigeria" *Proceedings of the Ist Urhobo Economic Summit '98*, Urhobo Foundation.

Ovuokporaye, S. I. (2016): A Study of Gas Flare on Cardiopulmonary Parameters of Residents in Gas Flaring Communities in Selected Niger Delta States. Unpublished Ph.D Thesis, Delta State University, Abraka.

Uwakonye, M, et, al. (2006). "The Impact of Oil and Gas Production on the Nigerian Economy: A Rural Sector Econometric Model", *International Business and Economics Research Journal* (IBER) 5(2)

CHAPTER

2

GAS FLARING IN UGHELLI NORTH LOCAL GOVERNMENT AREA: CONSEQUENCES AND REMEDIES

Emmanuel O. Ndakara, PhD

1. Introduction

In every location like Ughelli North Local Government Area in Delta State, the presence of natural resource such as gas is seen as a blessing to the people due to its significant importance in socio-economic development, with respect to improving the standard of living of the inhabitants.

Indeed, natural gas has been used by humans for different purposes over several decades in different regions of the world, Ughelli North region inclusive. However, despite the immense importance of the natural gas, the process of harnessing it has left the region's inhabitants with untold hardship because of environmental degradation resulting from the emissions from gas flaring and oil spillage.

The environment of Ughelli North region has been negatively impacted by the activities of oil and gas exploration and exploitation. The impacts are highest within the communities that house the different flow stations at Agbarha-Otor, Evwreni, Ogor, Eruemukohwoarien and Orogun/Kokori due to distance decay theory which

emphasises that the impact of gas flaring increases with closeness to the flaring sites than the adjoining neighbourhood. Therefore, within Ughelli North area, gas flaring has tremendous negative impact on the environment by causing air pollution, soil pollution, water pollution, biodiversity loss, reduction in agricultural productivity, deforestation, and ill-health.

Emissions from flaring have adverse health impacts on the inhabitants within the gas flaring region. Studies have revealed that emissions from gas flaring lead to health problems such as asthma, cancer (especially thyroid cancer), respiratory diseases among children, heart diseases, and stroke. A study carried out by Chen, *et al*. (2022) reported that emissions from gas flaring caused an increase in respiratory diseases, heart diseases, 49 premature deaths annually, 4,960 respiratory diseases among children, 120 asthma attacks, and strokes due to black carbon particle exposure. Similarly, a study carried out by Buonocore et al. (2023) reported that gas flaring caused premature deaths of 7,500 humans, and 410,000 asthma exacerbations in the United States annually.

In Nigeria, gas is being increasingly seen as a viable source of energy to speed up developmental needs. For that reason, it becomes difficult to put a stop to the flaring activities. However, for the purpose of improved environmental quality and human health, the need to adopt alternative options to remedy the prevailing consequences of gas flaring becomes quite imperative.

2. Empirical Review of the Consequences of Gas Flaring

Several studies have investigated the resultant consequences of gas flaring in the Niger Delta region, and within Ughelli North Local Government Area in particular.

The study carried out by Ovuakporaye (2016) to investigate how gas flaring affect cardiopulmonary

parameters of residents of Agbarha-Otor and selected communities within the Niger Delta region, reported that gas flare increases mean pulse, respiratory and blood pressure of residents living in the gas flare areas. Emumejaye (2012) investigated the effects of using gas flare to dry tapioca (kpokpo-Garri) at Gana flow-station in Agbarha, Delta State, Nigeria. The study reported that the chemical benzene which is associated with using gas flare heat to process food is particularly hazardous, causing leukaemia and other blood-related disorder. Women approaching the flare and people eating the processed food are particularly at risk. A study by Okafor, *et. al*. (2011) on the effects of gas flaring on the environment of Ughelli, Sapele and Amukpe, reported that gas flaring impact negatively on the soil pH, soil moisture and nitrogen content of soil. Agboje, *et. al*. (2023) investigated effect of crude oil exploration on the availability of non-timber forest products in Ughelli North Local Government Area, Delta State, Nigeria. Findings from the investigation revealed that the non-crude oil producing communities had a relatively higher measure of availability of non-timber forest products (NTFPs). Crude oil exploration activities had a significant effect on the availability of NTFPs used as medicine (t-2.465, p, p0.05) and fuel wood (t-1.050, p>0.05). Mogborukor (2019) carried out an environmental impact assessment of gas flaring on groundwater quality in Ughelli North. The findings showed that most chemical parameters of borehole and well water in Ughelli North communities are lower than the recommended limit by World Health Organisation. Ito and Ugbome (2017) carried out a study to investigate the impact of gas flaring on biodiversity in Niger Delta, Nigeria. The study showed that gas flaring has negative effects on the flora and fauna of the ecosystems through extinction of biodiversity, destruction and contamination of soil, and atmospheric pollution. The study

showed that gas flaring has impoverished the communities where it is practiced, with attendant environmental, economic and health challenges. A study by Nwafor (2013) reported that there is strong evidence that people in the Niger Delta region are exposed to harmful dangerous pollutants such as nitrogen oxides, sulfur dioxide, and ozone exposures, which are important contributors to chronic obstructive pulmonary diseases. A study carried out by Atuma and Ojeh (2013) to examine the effect of gas flaring on soil and cassava productivity in Ebedei, Delta State reported that soil within the gas flaring site is higher in temperature, sand composition, and more acidic than areas at distance away from the flaring site. The soil electrical conductivity, Phosphorous, Nitrogen, Potassium and Sodium were very low; while cassava yields increased with a corresponding increase in distances from flare site. Akeem and Anifowose (2016) investigated the effect of gas flaring on a part of the environment of the Niger Delta Region of Nigeria using Remote Sensing and GIS in assessing the impact of gas flaring on water quality, land surface temperature, and vegetation cover. The study revealed that gas flaring as a significant factor responsible for unfavorable water quality, high temperature variation and the rapid decline in the health of natural vegetation of the study area. The pH and nitrate values obtained were not within the standard limits set by W.H.O.; they range between 4.12-6.04 and 80.50-88.30mg/l respectively. Values range between 0.0-0.04 mg/l for Pb, 0.01-1.20 mg/l for Fe, 39.98-245.60 mg/l for SO4, and 0.0-7.0 mg/l for TDS. The area covered with vegetation reduced from 63.0% to 54.2% and to 46.4%, with the area occupied by unhealthy vegetation increasing from 49.61% to 53.87% and a further decrease to 48.1%. Nkemdilim (2021) studied the impact of gas flaring on human health within communities in Delta region of Nigeria. The study shows that nearness to gas flare sites increases the negative health impact on humans.

3. Aim and Objectives of this Paper

The aim of this paper is to examine gas flaring in Ughelli North Local Government Area (LGA) with respect to its consequences and remedies. Therefore the specific objectives are to:

i. examine gas flaring as a concept and activity;

ii. outline the remote and general causes/ reasons for gas flaring;

iv. present the consequences /effects of gas flaring in Ughelli North region; and

v. provide remedy options to the consequences of gas flaring in Ughelli North LGA.

4. Gas Flaring As a Concept and Activity

Gas flaring involves burning off natural gas that is produced alongside oil extraction. It emphasises the controlled burning of natural gas, often a by-product of oil extraction that occurs when there is no infrastructure to capture and utilize the gas, or when it is deemed economically unviable to do so (see fig. 1).

Fig. 1: Gas Flaring Site

Gas flaring as shown in figure 1 above involves the burning of excess hydrocarbons gathered in an oil and gas production

flow station or site. The burning of such gases releases huge volumes of greenhouse gases to the atmosphere, while emitted sulphur dioxide returns to the soil as acid rain. The main components of the flared gases include carbon (iv) oxide (CO_2), methane (CH_4), nitrous oxide (NO_2), water vapour and sulphur dioxide (SO_2). These emissions cause damages to the environment and its components, as well as human lives.

5. Remote and General Causes of Gas Flaring

The remote and general reasons natural gas is flared are as follows:

i. **Lack of infrastructure:** Oil companies may not have the necessary pipelines or equipment to capture and transport the gas for use or sale.

ii. **Prevention of explosions:** Natural gas is flared for the purpose of pressure relief to prevent the risk of explosions from simply venting large amounts of reactive gases.

iii. **Removal of waste product:** Natural gas is flared to help in the removal of waste product from chemical production processes. This occurs where pipelines and other gas transportation infrastructure are lacking thus, vast amounts of such associated gas are commonly flared as waste or unusable gas.

iv. **Production flaring:** At oil and gas extraction sites, gas flares are similarly used for a variety of startup, maintenance, testing, safety, and emergency purposes. In a practice known as production flaring, they may also be used to dispose of large amounts of unwanted associated petroleum gas, possibly throughout the life of an oil well.

v. **Shutdown of equipment:** At the refineries, the crude oil refining process generates gases that are transported throughout the refinery's process units through a piping system. Unexpected events that cause the operating equipment such as pumps and compressors to shut down can lead to flaring.

vi. **Economic factors:** It can be cheaper and more practical to burn the gas off-site than to invest in infrastructure to capture and process it.

vii. **Emergency situations:** Flaring can also be used as a safety measure to prevent the uncontrolled release of gas in certain situations.

6. Consequences of Gas Flaring

Like many other regions where gas flaring takes place, Ughelli North region has been faced with several consequences owing to gas flaring activities. Flaring results in the release of substantial volumes of potent Green House Gases (GHGs), including methane, black soot and nitrous oxide. This has impacted negatively on the environment, as well as human health as presented below:

i. **Global warming:** Gas flaring contributes to global warming which could accelerate the problem of climate change and harsh living conditions on earth, if not checked. Flaring releases carbon dioxide and methane, the two major greenhouse gases. Excessive carbon dioxide stores heat in the atmosphere. The radiation of heat from the earth surface is usually absorbed by the greenhouse gases in the stratosphere and troposphere causing a rise in temperature, thereby generating heat in the atmosphere. This has impacted greatly on the human physiological comfort, and crop productivities within Ughelli North.

ii. **Ozone layer depletion:** Gas flaring leads to the depletion of the ozone layer thereby increasing the net solar radiation. This has implications on increasing the air temperature which affects the environment and its components, including humans.

iii. **Acid rain:** Emissions from gas flaring release sulphur dioxide (SO_2) and nitrogen oxides (NO) to the atmosphere. These combine with atmospheric moisture to form acid rain which is detrimental to the environment. Acid rain acidifies lakes and streams and damages vegetation. In addition, acid rain accelerates the decay of building materials and paints. Prior to falling to the earth, SO_2 and NO_2 gases and their particulate matter derivatives, sulphates and nitrates, contribute to visibility degradation and harm public health.

iv. **Greenhouse gas emissions:** Flaring releases carbon dioxide (CO2) and other greenhouse gases into the atmosphere, contributing to climate change.

v. **Air and water pollution:** The flaring process also releases pollutants like black soot and nitrogen oxides, which can negatively impact air quality, water quality, and human health. While polluted water leads to the death and migration of aquatic organisms, polluted soil does not support effective agricultural production.

vi. **Effects on human health:** Emissions from flaring have adverse health impacts on the inhabitants within the gas flaring region. Emissions from gas flaring lead to increase in respiratory diseases, heart diseases, and death of humans.

vii. **Impacts on agricultural productivity:** The effluents associated with gas flaring give rise to atmospheric contaminants. These contaminants acidify the soil, hence depleting soil nutrient. Most farmers have

lost their means of livelihood, as it has negatively impacted fertility of lands and the ecosystem. Acid rain reduces the pH, which make the soil lose nutrients due to increased acidity in the soil. The soil is poisoned by toxic substances like aluminium, and the essential NPK (Nitrogen, Phosphorus and Potassium) and all other minerals are dissolved by the acidic water.

viii. **Gas flaring impacts on soil qualities:** Gas flaring reduces the cation exchange capacity (CEC) of soil thus, leads to reduction in the fertility status and nutrient contents of the soil (Izah et al., 2017). Exchangeable cations are one of the most important chemical bases of soil fertility hence their deficiencies account for the nutrient status characteristics of soil within any given area.

ix. **Gas flaring impacts on vegetation:** Emissions from gas flaring have greatly effected the vegetation floristics and fauna components. Aside the reduced population of both plants and animals, several species of both flora and fauna are becoming threatened, which can easily lead to the extinction of such plants and animals species from the region.

7. Remedy Options to the Consequences of Gas Flaring

Oil sales supply major revenue to the government, and a high share of Nigeria's oil fields have associated gas. Therefore, it will be very difficult to shut down the oil fields and cut off the income they provide, irrespective of the consequences of gas flaring to the environment and human health. Therefore, the following remedy options can be adopted to salvage the resultant effects of gas flaring in Ughelli North region.

i. **Gas capture and utilization:** Investing in infrastructure to capture and use the gas for power generation, industrial processes, or transportation fuels is a viable alternative to flaring.

ii. **Gas re-injection:** In some cases, the gas can be re-injected into the oil reservoir to maintain pressure and enhance oil recovery.

iii. **Liquefy gas:** Another alternative solution to gas flaring is to liquefy the gas and store in bottles or vessels as liquid gas. This is relatively safer and more economical compared to flaring of gases.

iv. **Biogas flaring:** This process involves boring holes and laying perforated pipes throughout the landfill. A vacuum pump extracts the gas, which is then burned in an enclosed system, converting the methane into water and carbon dioxide. While carbon dioxide is still a greenhouse gas, it is far less harmful than methane.

v. **Expand gas infrastructure:** Building pipelines and liquefied natural gas (LNG) plants to capture and transport excess natural gas instead of burning it off is crucial.

vi. **Develop local gas markets:** Focus on creating local demand for gas, such as building gas-fired power plants, piping gas to local industries for heat and power, and establishing compressed natural gas (CNG) filling stations.

vii. **Flare gas power generation:** Convert flare gas into an electricity-generating process using small-scale generators.

viii. **Flare-Gas-To-Liquids (GTL) Technology:** Transform waste gases generated from flaring into

valuable liquid fuels like diesel, gasoline, or jet fuel, providing a practical and sustainable use for excess natural gas.

8. Conclusion

Gas flaring is one of the major problems affecting the environment and inhabitants of Ughelli North LGA. This has led to untold hardship to the inhabitants of the region owing to the resultant consequences with respect to human physiological comfort, acid rain, water and air pollution, reduced soil quality, deforestation, biodiversity loss, low agricultural productivity, and human health. A call for immediate remedy options is required to salvage the environment and the inhabitants of this region. Therefore, both the government and the oil companies should rise up to the challenges of addressing the situation for a sustainable environmental functioning.

References

Agboje, I., Salami, K.D., Akhideno, I. O., Bakpolor, V. R., Yusuf, A. S., Fadahunsi, M. O. and Asonibare, A. O. (2023): Effect of Crude Oil Exploration on The Availability of Non-Timber Forest Products in Ughelli North Local Government Area, Delta State, Nigeria. Ethiopian Journal of Environmental Studies & Management, 16(3): 304 – 320.

Akeem, N. A., and Anifowose, A. Y. B. (2016): Effect of Gas Flaring on the Environment: A Case Study of a Part of Niger Delta, Nigeria. American Geophysical Union, Fall Meeting.

Atuma, I. M. and Ojeh, N. V. (2013): Effect of Gas Flaring on Soil and Cassava Productivity in Ebedei, Ukwuani Local Government Area, Delta State, Nigeria, Journal of Environmental Protection, 4 (10): 1054-1066.

Egwurugwu, J.N., Nwafor, A., Chinko, B.C., Oluronfemi, O.J., Iwuji,S.C.andNwankpa, P. (2013). Effects of prolonged exposure to gas flares on the lipid profile of humans in the niger delta region, Nigeria. American Journal of Research Communication. 1(5): 115 145.

Emumejaye, K. (2012). Investigation of the Effects of Using Gas Flare to Dry Tapioca (kpokpo-Garri) at Gana Flow-Station in Agbarha. Delta State, Nigeria. IOSR Journal of Applied Physics vol. 2(5): 6-10.

Ito, E.E., and Ugbome, I. L. (2017): Impact of Gas Flaring on Biodiversity in Niger Delta, Nigeria. Nigerian Journal of Science and Environment, 15 (1): 147 – 154.

Mogborukor, J. O. (2019): Environmental Impact Assessment of Gas Flaring on Groundwater Quality in Ughelli North of Delta State, Nigeria. Jalingo Journal of Social and Management Sciences, 1 (4): 239 – 249.

Nkemdilim, I. O. (2021): Study of the Impact of gas flaring on the health of communities in Delta region of Nigeria. Unpublished Ph.D Thesis, Charles Sturt University.

Nwafor, A. (2013). Life Under assault. Nowhere to hide. An inaugural lecture series no. 102

Okafor, C. S, Igwilo, I. O., Oparaji, C. A., Umeoguaju, U. F., and Enemor, V. H. A. (2011): Effects of gas flaring on the environment, using the Niger Delta area of Nigeria as a case study. ESAIJ, 6(4): 209-211.

Ovuokporaye, S. I. (2016): A Study of Gas Flare on Cardiopulmonary Parameters of Residents in Gas Flaring Communities in Selected Niger Delta States. Unpublished Ph.D Thesis, Delta State University, Abraka.

CHAPTER

3

THE HEALTH HAZARD OF GAS FLARING, CONSEQUENCES AND REMEDIES

Dr. M. I. Ntaji

Introduction

Gas flaring is the controlled burning of natural gas during the process of crude oil extraction. Another definition stated that, gas flaring (GF) is burning off gases produced by chemical plants, oil refineries, oil wells, rigs, landfills, gaseous waste, and other production sources at the tip of an elevated vertical chimney. This practice is prevalent in oil-rich developing nations like Nigeria. And in Nigeria it is common in the Niger Delta area. The practice is resorted to due to lack of infrastructure to capture and utilise the associated gas.

GF and its health effects is captured in environmental health component of public health. Gas flaring (GF) results not only in the wastage of valuable energy resources, but also in the release of hazardous pollutants into the atmosphere. In Nigeria, the Niger Delta region, rich in oil resources has borne the brunt of gas flaring toxic effluent. The exploration of crude oil in the Niger Delta of Nigeria, results in the flaring of 17.2 billion cubic meter amount of

flared gas and it is estimated that this amount of flared gas approximates one quarter of the power consumption in the entire African continent. In 2019, 99% of the global population resided in areas where air quality exceeded World Health Organization (WHO) limitations. Nigeria was listed among the seven nations that contributed 66% of the global gas flaring, with over 170 gas-flaring sited all situated in the Niger Delta region.

Communities in this area experience daily exposure to pollutants that compromise their health and quality of life. This is compounded by global environmental consequences such as climate change. Gas flaring can occur during well testing, production operations and safety situations, where flare systems burn off excess gas to prevent dangerous pressure buildup in equipment.

Health Effects of Gas Flaring

What is a health hazard? Gas flaring constitutes a health hazard; and from occupational and environmental health perspective, a health hazard is any material, substance, or a circumstance which poses a danger to human health and well-being.

Gas flaring emits hazardous pollutants which can affect almost all systems of the body- the respiratory, cardiovascular, reproductive, neurological and dermatological systems, haematological system.

Health Pollution and Respiratory Problems

The most commonly affected system by GF in the respiratory system. This is because the pollutant exists in the atmosphere where it is inhaled into the body through the respiratory tract. Pollutants from gas flaring include- sulfur dioxide (SO2), nitrogen oxide (No2), carbon monoxide (CO), hydrogen sulfide, xylene, dioxin, heavy metals and volatile

organic compounds (VOC). These substances reduce the quality of air and lead to respiratory ailments such as asthma, chronic bronchitis, chronic obstructive airway disorders and lung infections. Continuous inhalation of these toxic emissions inflames the respiratory tract and reduces lung function, especially among children and the elderly. Gas flaring also releases toxins such as benzene, toluene and black carbon into the atmosphere. Research shows that asthma prevalence is 2.5 times higher in flaring-exposed communities, with increased cases of chronic obstructive pulmonary disease (COPD) and bronchitis.

Cardiovascular System and Gas Flaring

Emitted air pollutants primarily affect the respiratory tracts, but other systems also affected comprise the cardiovascular system- consisting of the heart and blood vessels. Particulate matters penetrate deep into the blood stream, worsening cardiovascular condition leading to arterial plaque buildup, cardiac arrhythmias, stroke and cardiac arrest. Prolonged exposure to air pollutants has been linked to endothelial dysfunction and myocardial infarction. Populations living within 5 kilometers of gas flaring sites experience 35% higher rates of hypertension compared to those in non-flaring areas. A study in Port Harcourt, Rivers State, found that individuals exposed to high levels of NO, and PM, ... had a 2.3-fold increase in hypertension rates compared to unexposed individuals.

Adverse Pregnancy Outcomes and Birth Defects

Expectant mothers living near gas flaring zones face increased risk of pregnancy-related complications such as developmental disorders, premature births, spontaneous abortion, birth defects and low birth weight. Examples of such congenital defects are hydrocephalus, club feet, cleft

lips and cleft palate. Furthermore, exposure to heavy metals and VOCs from gas flaring has been linked to reduced fertility and hormonal imbalances, further highlighting the reproductive health risks posed by this practice. Volatile organic compounds such as benzene and toluene can disrupt endocrine functions, affecting reproductive hormones and foetal growth.

Neurologic Effects

Gas flaring releases neurotoxic pollutants, including heavy metals (lead, mercury, arsenic), volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxides (NO“), and fine particulate matter (PM, …. , PM €). These pollutants cross the blood-brain barrier (BBB), trigger oxidative stress, cause neuroinflammation, and disrupt neurotransmitter function, leading to headaches, dizziness, nausea, vomiting, seizures and cognitive impairment. Heavy metal exposure, particularly lead (Pb) and mercury (Hg), has been linked to cognitive decline, neurodevelopmental disorders, and an increased risk of neurodegenerative diseases such as Parkinson's and Alzheimer's.

Eye and Skin Effects

Exposure to the intense heat, light, and chemical residues from GF leads to skin and eye issues such as conjunctivitis, blurry vision, and skin irritations.

Cancer Risk and Gas Flaring

Benzene, a common emission from GF is associated with leukaemia, and other blood borne cancers. Long term exposure to flaring emissions has been shown to increase cancer prevalence in affected communities. Skin cancer and liver cancer have also been reported in oil-rich areas with prolonged exposure to hydrocarbon pollution. Gas flaring

releases benzene and toluene, which are carcinogenic. These compounds damage cellular DNA and promote tumour growth. Cancer rate is heightened in communities proximal to gas flaring. The release of carcinogenic pollutants such as benzene, formaldehyde and PAH from gas flaring increases the risk of developing cancer in population living close to gas flaring sites. Studies among humans have shown these high levels of these carcinogens in blood and urine samples of people living in such areas. This further underscores the carcinogenic risk associated with gas flaring.

Mental and Psychological Distress

The constant noise, light, and fear of explosions lead to sleep disturbances, anxiety, stress, and depression.

Vulnerable Population and Gas Flaring

The vulnerable population who are disproportionate badly affected by gas flaring include- children, pregnant women and the elderly. The reason is that, the developing immune systems of children, the physiological changes in pregnancy, and the often weakened immune systems of the elderly make these groups less capable of coping with toxic exposure.

Environmental and Socioeconomic Consequences

A. Climate Change Contribution

GF releases huge quantities of carbon (IV) oxide (CO2) and Methane (CH4), both of which are potent gases that exacerbate climate change. Methane though emitted in smaller quantity has a global warming potential over 25 times greater than CO2 over a 100 year period. Nigeria contributes one of the highest volumes of gas flare emissions globally, thereby accelerating climate change.

B. Acid Rain and Soil Degradation

The release of SO2 and NO leads to the formation of acid rain, which lowers soil pH and depletes nutrients required for plant growth.

Acidified soil affects microbial activity and reduces agricultural productivity. The deposition of heavy metals such as lead, cadmium, and nickel, as well as polycyclic aromatic hydrocarbons (PAHs), has been documented in soil and water samples near flaring sites. These pollutants accumulate in the food chain, rendering risks to both human health and biodiversity.

C. Displacement and Livelihood loss

Oil exploration activities including flaring, often leads to the displacement of communities. Residents are forced to migrate from severely polluted areas. Land is degraded and water bodies contaminated, forcing residents to abandon farming and fishing which is their traditional source of livelihood.

D. Agricultural Impact

Thermal radiation from flared stacks causes desiccation and damage to crop. Pollutants settle on plant surfaces, affecting photosynthesis and overall growth. These agricultural losses further impoverish affected communities.

E. Biodiversity and Ecosystem damage

Heat and light from flaring alters microclimate and introduces toxic substances into the ecosystems. Wide life migration patterns are disrupted and aquatic life suffers from oxygen depletion caused by hydrocarbon run-off. The long-term ecological damage affects wild life habitat and biodiversity. GF can lead to population decline or extinction of sensitive species.

F. Noise Pollution

Gas Flaring generates intense noise, disturbing local wildlife and human population.

G. Economic Impact

Families living in such gas flaring communities face increased healthcare costs due to recurrent visits to health facilities following pollution-related health challenges. There is also loss of productivity due to absenteeism from work related to illness associated with gas flaring. This affects individuals, families and Nigeria's overall economic output. The economic burden of GF is estimated at 7.4 billion dollars annually due to healthcare cost, lost productivity and environmental degradation.

Remedies

Addressing the health effects of gas flaring requires a multi-pronged approach which should involve the government, industries, communities and individuals.

A. Legal and regulatory measures

A Strong Legal Framework Is Essential In Combating Gas Flaring. Nigerias gas flaring reduction (Prohibition and punishment.

Bill of 2017 mandates zero routine flaring and penalises violations. However, enforcement remains a challenge due to corruption and limited capacity.

B. Gas Capture and Utilisation

Technological innovations offer sustainable alternatives to flaring. Associated gas can be re-injected into wells, converted to liquified natural gas (LNG), or used for electricity generation.

The World Bank (2020) support such initiatives under its global gas flaring reduction partnership.

Implementing these systems requires huge investment but promises environmental and economic returns.

C. Environmental Monitoring and Health Surveillance

Regular air quality monitoring and public health surveillance are critical.

Data-driven approaches help detect health trends and guide intervention.

Community clinic should be equipped to handle flare-related illnesses and conduct periodic health screening.

D. Community Engagement and Compensation

Affected communities must be actively involved in decisions on oil exploration and mitigation strategy. Compensation schemes should address both environmental damage and health outcome.

E. Public Awareness and Education

Measures should be carried out by government and non-governmental bodies to educate the communities about the health risks associated with GF and promote practices that can mitigate exposure. These educational campaigns should target schools, community groups and local government, promoting advocacy and behavioural change.

F. Financial penalties and Incentives

Implement higher fines for gas flaring and provide incentives for companies that invest in gas utilisation projects.

H. Investment in renewable Energy.

I. Promote the Development and adoption of renewable energy sources to reduce reliance on fossil fuels and associated flaring.

Conclusion

Gas flaring remains a serious health and environmental hazard, particularly in resource-rich but infrastructure deficient regions like the Niger Delta.

The myriad of health complications – respiratory, cardiovascular, carcinogenic, and reproductive- necessitates urgent action.

Additionally, the socioeconomic and ecological consequences deepen poverty and undermine development.

While policies and technological remedies exist, implementation and enforcement lag behind.

Further Reading

UNEP. Environmental Assesment of Ogoniland. Nairobi. United Nations Environmental Programme, 2011.

Ovuakporaye SI, Igweh CJ, Aloamaka CP. Impact of Gas FlaringonCardiopulmonary Parameters of Residents in Gas Flaring Communities in Niger Delta Nigeria. British Journal of Medicine & Medical Research. 2016; 15(6): 1-13.

Afinotan U. How serious is Nigeria about climate change mitigation through gas flaring regulation in the Niger Delta? Environ Law Rev. 2022; 24(4):288–304.

World Health Organisation. Ambient (Outdoor) Air Pollution; WHO: Geneva, Switzerland, 2021. **[Google Scholar]**

National Asthma Education and Prevention Programme Expert (NAEPP). Panel Report: Guidelines for the Diagnosis and Management of Asthma; 2014.

Asuzu MC. Principles ofHazard Control and Disease Prevention in Occupational Health and Safety. Occupational Health. 2009; Afrika-Link Communication, University of Ibadan. Chapter 3:10.

Agerton M, Gilbert B and Upton G, The Economics of Natural Gas Venting, Flaring and Leaking in U.S. Shale: An Agenda for Research and Policy. 2020; USAEE Working Paper No. 20-460

Alimi O, Gibson J. The Impact of Gas Flaringon Child Health in Nigeria. World Bank Blogs, 2024; Accessed 6/4/2025

Nduka JK, Orisakwe OE. Acid rain and its implications on the ecosystem in Nigeria. ScientificWorld Journal, 2011; 11:1181-1187.

Aye I, Wingate EO. Nigeria's Flare Gas Regulation-Prevention of Waste and Pollution 2018. Environmental Law Review 2019; 21(2): 119-127.

Ovuakporaye SI, Ofoma AE, Nwagbara OA, Eghwrudjakpor PO, Ojieh AE. Effectsof Gas Flaring on the Lungs of humans in the Niger Delta region of Nigeria. Research Journal of Environmental and Earth Sciences. 2012; 4(5): 525- 528.

Akpan AO. Environmental Sustainability: Assessing the Impact of Air Pollutants Due to Gas Flaring- Qua Iboe Estuary Case. World Journal of Environmental Engineering 2016;4(1):1-5.

GGFR (Global Gas Flaring Reduction), 2020. 2020 Global Gas Flaring Tracker Report [Online] Available at https://www.worldbank.org/en/programmes/gasflaringreduction [Accessed 8/4/2025]

Agochi OC. Gas Flaring in the Niger Delta Nigeria: An Act of Inhumanity to Man and His Environment. International Scholarly & Scientific Research and Innovation 2014; 8(7): 2346- 2349.

Odjugo PAO, Osemwenkhae EJ. Natural Gas Flaring affects microclimate and reduces maize (Zea mays) yield. International Journal of Agriculture and Biology, 2010; 12 (4): 508-511.

Jato DJ, Onyije FM, Mgbere OO, Avwioro GO. Exposure to Gas Flaring among residents of Oil-Producing communitiesin Bayelsa State, Niger Delta region of Nigeria: A Cross-Sectional Study of Haematological Indices. Multidisciplinary Scientific Journal. 2024; 7(4): 472- 481.

APPENDICES

Appendix One: Good will Message from the Ministry of Oil and Gas, Delta State

My name is Onobraekpeyan Edwin, Director of Gas, and I am here to represent my Permanent Secretary, Mr. Frank Omoko, who is unavoidably absent. He sends his warm regards.

The issues surrounding gas flaring are topical and have been at the forefront. Gas flaring by oil and gas companies is an unfortunate practice because it is easier and cheaper to flare and pay the penalties. The rate set by the regulator under the federal government has been in the range of $ 10 for 1000 standard cubic feet of gas.

While the Delta State Government does not support gas flaring, it cannot sanction oil and gas production companies since that subject matter falls under the exclusive list of governance. However, the state government encourages gas utilization schemes and projects.

To this end, the state government is ready to partner with capable and willing investors who are desirous of building natural gas processing plants into LPG, LNG, and CNG. Investments in power production using natural gas are also welcomed.

It is pertinent to note that the state government recently signed an MoU with NIPCO to build infrastructure for the production and dispensing of CNG for use by vehicles for transportation.

The State Government is also poised to partner with willing private investors and host communities to build power infrastructure that will utilize otherwise flared gas .

The State Government has intervened in the case of the Uzere community to enable them to access gas within the operational area of Heritage Oil facilities to use gas to power its Independent Power supply.

Thus, the state government supports advocacy to end gas flaring because it is detrimental to our environment and the health of every individual.

Appendix Two: Goodwill message from the Ministry of Environment, Delta State

A goodwill message by the Permanent Secretary, Delta state Ministry of Environment, Dr Mrs. Oseji M. I at the presentation of the research report on gas flaring in Ughelli North Local Government Area, Delta state holding on the 11th of April, 2025 at Delta State University, Abraka

Protocol

It is with great honor and a deep sense of responsibility that I am present here at this vital and timely paper presentation.

Today, we gather not only to witness the unveiling of a significant research project but also to engage in a meaningful dialogue on a subject that deeply affects our environment, our economy, and the well-being of our people – gas flaring in Ughelli North Local Government Area.

This presentation, titled "An Insightful Discourse on Environmental Health and Socioeconomic Impact of Gas Flaring in the Region", promises to shed light on one of the most pressing environmental challenges of our time. Gas flaring, while often viewed as a by-product of industrial activity, is a direct threat to public health, agricultural productivity, and environmental sustainability.

Ughelli North, like many communities in the Niger Delta, has borne the brunt of this environmental hazard. The consequences are evident in our air, our water, and our soil. But perhaps most profoundly, in the livelihoods and health of the people who live in affected areas. The social and economic dimensions are equally critical as communities face displacement, loss of income and long-term health complications.

But today is not just about highlighting the problems. It is also about showcasing solutions. It is hoped that this report

presents not only a detailed assessment of the impacts of gas flaring but also introduces the latest scientific and technological methods that help reduce and ultimately eliminate this harmful practice. The insights will be invaluable to policymakers, scientists, industry stakeholders, and community leaders alike.

I extend sincere appreciation to the authors and contributors of this research, as well as to every stakeholder here who continues to champion the cause of environmental justice and sustainability. Your commitment and collaboration are what will drive real change in our communities.

As we proceed with this presentation, I urge you all to engage fully, share your perspectives, and explore how we can collectively implement the findings and recommendations that will emerge from this research.

Let us take this opportunity not only to listen but to act — for the sake of our environment, our economy, and most importantly, our future generations.

I wish us a fruitful and impactful session.

Thank you.

Flames of Injustice: Health and Environmental Costs of Gas Flaring in Ughelli North, edited by Dr. Otive Igbuzor and Monday Osasah, is a compelling exposé on the devastating consequences of gas flaring in Nigeria's Niger Delta, particularly Ughelli North in Delta State. Published by The Ejiro & Otive Igbuzor Foundation in 2025, the book draws from comprehensive research supported by the Global Green Grants Fund and executed by a dedicated team led by Prof. Sunny Awhefeada. It provides an in-depth analysis of the environmental degradation, health hazards, and socio-economic implications of prolonged gas flaring in oil-producing communities. Through a mix of field surveys, personal testimonies, and scientific assessments, the book documents the suffering of affected populations, the silence and complicity of oil corporations, and the inadequate regulatory responses from government authorities. It calls for urgent action—through advocacy, policy reform, and community mobilization—to end this long-standing environmental injustice. Ultimately, *Flames of Injustice* is a passionate call for equity, environmental sustainability, and the protection of human rights in Nigeria's oil-rich but deeply afflicted regions.

ISBN 978-978-918-906-9

9 789789 189069

KRAFT BOOKS LIMITED

Flames of Injustice

Otive Igbuzor | Monday Osasah

KRAFT