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Exploring the Relationship Between Artisanal Crude Oil Refining; Soot Production and the Rising Prevalence of Non-Communicable Diseases in the Niger Delta Region of Nigeria. An Urgent Call to Action

Dr. Ebimene Singabele

University of Lincoln, Lincoln. United Kingdom.

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ABSTRACT

Nigeria produces over two million barrels of crude oil daily, almost all of this crude oil is found in the Niger delta region of the country. Despite the huge revenue coming from crude oil to Nigeria, the Niger delta region is one of the least developed world-wide its and indigenes are among the poorest in Nigeria and in Africa. This is mainly because of loss of livelihood following crude oil spillage which pollutes both land used for farming and rivers used for fishing. This loss of livelihood coupled with neglect and underdevelopment of the Niger delta has provided the incentives for artisanal refining which is also known as illegal refining. The air is polluted from black soot which is formed from the artisanal refining of crude oil which involves primitive methods of refining crude. This has led to the development of respiratory tract illnesses, cancers and other health conditions in individuals living in the Niger delta region of Nigeria. There are currently a number of government interventions put in place to tackle the environmental degradation in the Niger-delta. Also a number of suggestions have been made to help mitigate the soot menace.

Keywords: Crude oil exploration, Crude oil refining, Petroleum refineries, Niger delta, Oil spill, Artisanal refineries, Soot, PM 2.5, Respiratory illnesses, Cancers

INTRODUCTION/ HISTORY OF CRUDE OIL IN NIGERIA

Crude oil was first discovered in Nigeria at Oloibiri community now in Bayelsa state in 1956 by Shell Petroleum Development Company (S.P.D.C.) and the commercial exportation of crude oil started in 1959 (Fyneface et al., 2022; Ikezam & Elenwo, 2021). Before the discovery of crude oil, the main source of livelihood for people living in the Niger-delta region of Nigeria was agriculture (Mezie Okoye, 2022; Ogele & Egobueze, 2020). Up till 2022, Nigeria continued to be the largest producer of crude oil in the African continent and one of the greatest producers of oil and gas world-wide (Amuda et al., 2023). Amongst the oil producing countries, Nigeria is the sixth greatest producer and exporter of crude oil word-wide (Ahmed & Usman, 2023; Suku et al., 2023). Over two million barrels of crude oil are produced daily in the Niger-Delta region of Nigeria, but there is scarcity of refined petroleum products and inability to meet the daily demands of refined petroleum products like diesel, kerosene, fuel and gas for people living in the Niger delta and all over Nigeria (Ahmed & Usman, 2023). Some scholars state that Nigeria produces more than 2.5 million barrels of crude oil daily (Richard et al., 2022). Nigeria has about 159 oil fields and 1481 oil wells, most of which are in the Niger-delta (Omozue, 2021). Oil and Gas resources from the Niger-delta region of Nigeria contribute massively to the economy of Nigeria and are responsible for about 90% of foreign exchange earnings coming to Nigeria (Suku et al., 2023). At the start of this millennium, oil and gas exports contributed to about 98% of income to Nigeria, 83% of Federal Government revenue and 14% of the Gross Domestic Product of Nigeria (Ogbon et al., 2018). As of 2016 crude oil contributed to over 90% of Nigeria's export and foreign exchange income and more than 70% of the country's revenue (Okolo & Anthony, 2019). According to Omozue (2021), Nigeria's crude oil is high in demand globally and it is mostly known as "Light and Sweet" or Bonny light because it does not have any Sulphur (p.114). Ogbuigwe (2018) reveals that Nigeria`s Bonny light crude is close in composition to the crude oil found in the North-sea and also identified Qua Iboe, Brass River, Foracdos and Escravos blend as other types of crude oil

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found in Nigeria. Among Organisation of the Petroleum Exporting Countries (O.P.E.C.) members, Nigeria is the number one producer of sulphur free crude oil (Ogbuigwe, 2018).

O.P.E.C. and N.N.P.C

O.P.E.C. was created in 1960 to manage crude oil policies of member states and to give technical and also financial aid to its members. In 1971, Nigeria joined the O.P.E.C. Nigeria is the only O.P.E.C. member that lacks domestic refining capacity for majority of its crude oil and relies on importation of refined products especially Premium Motor Spirit (P.M.S.) to bridge the huge gap between demand for and supply of refined products (Ogbon et al., 2018). In 2023, the amount of refined fuel imported from European Union countries into Nigeria was about 250,000 barrels daily (Mbachu, 2024).

In 1977, the Nigerian National Petroleum Corporation (N.N.P.C.) was formed to manage the country's oil and gas resources (Ogbuigwe, 2018). Following the signing into law of the Petroleum Industry Act in 2021 by President Muhammadu Buhari, the N.N.P.C. has been privatised and is now known as the N.N.P.C. Limited (Naeyor et al., 2025). The Managing Director of the N.N.P.C. will be appointed by the President of Nigeria, while the Minister of Petroleum supervises the oil industry of Nigeria via the N.N.P.C. The government of Nigeria through Federal Ministries of Petroleum and Finance holds shares in N.N.P.C. (Naeyor et al., 2025).

Crude Oil Refining

Crude oil also called Petroleum is a naturally occurring liquid seen beneath the earth`s crust and is yellowish-black in colour (Fyneface et al., 2022). It is important to note that Petroleum or crude oil cannot be used in its original state and requires to be converted into beneficial products such as Liquefied Petroleum Gas (L.P.G.), Gasoline or Petrol, Kerosene, Jet fuel, Diesel oil etc (Ogbon et al., 2018). The process of converting or transforming Petroleum or Crude oil into beneficial products is called Refining and it this is done is specialized facilities called Petroleum refinery or Oil refinery (Ogbon et al., 2018). Based on operations, refineries are divided into: Modular refineries with a refining capacity of 500 to 50,000 barrels of crude oil per day and Conventional or Complex refineries with refining capacity of more than 100,000 barrels of crude oil per day (Ogbon et al., 2018). The basic method of operation of all refineries are the same and involve the following: Separation of crude oil into its component fractions which is commonly known as Fractional distillation, Conversion or Cracking and rearrangement of molecules and Treatment.

History Of Refineries in Nigeria

The first refinery in Nigeria became functional in 1965 and was named Shell-BP refinery, the refinery was built by S.P.D.C and was in Port-Harcourt; It was a privately owned refinery (Ogbuigwe, 2018). In 1972, the Federal Government of Nigeria (F.G.N.) bought 60% of shares in the refinery and changed the name of the refinery to Nigerian Petroleum Refining Company. By 1978 the F.G.N. bought the remaining 40% of shares and renamed the refinery Nigerian National Petroleum Corporation Refinery Port-Harcourt (Ogbuigwe, 2018).

As of 2023, Nigeria had 4 government owned refineries with a total refining capacity of around 445,000 barrels of crude oil daily (Suku et al., 2023). These refineries are semi-comatose and minimally functional and consequently the country must import refined petroleum products to satisfy domestic needs (Ogbon et al., 2018). It is argued that Nigeria is the only oil producing country globally that is unable to refine a considerable amount of the crude oil it produces locally as its 4 refineries are overwhelmed by financial and operational problems. Consequently, most of the crude oil is exported for refining and later the refined products are imported into the country. (Ogbon et al., 2018).

The four refineries are Port-Harcourt Refinery 1, Port-Harcourt Refinery 2 and Warri Refinery which are in the Niger-Delta region of Nigeria and the fourth being the Kaduna Refinery which is in Northern Nigeria (Ahmed & Usman, 2023). The Port-Harcourt Refinery 1 is the oldest refinery in Nigeria and became functional in 1965, the Warri refinery was launched in 1978, the Kaduna refinery was commissioned in 1980 and the Port-Harcourt refinery 2 is a newer refinery which became functional in 1989 (Ogbuigwe, 2018). According to the Nigerian Extractive Industries Transparency Initiative (N.E.I.T.I.), even if all the 4 Nigerian refineries were at full

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functional-capacity they will remain unable to meet the current daily demand of refined products in Nigeria. (Chikwem 2019).

Recent Refineries in Nigeria

Most recently in Nigeria, the Dangote refinery which is privately owned became operational in 2024 and has a crude oil refining capacity of about 650,000 barrels per day when fully functional (Mbachu, 2024). The refinery cost almost twenty billion dollars ($20bn) to build, is the largest Single-train refinery globally and one of the largest refineries world-wide (Muhammad et al., 2024). Single train means the refinery has one (1) integrated processing unit for distillation, cracking and treatment of crude oil. With the start of operations of the Dangote refinery there is hope that the importation of refined petroleum products into Nigeria will reduce and also the country can meet the current local demand for refined petroleum. (Muhammad et al., 2024). Currently, the refining capacity of Dangote refineries and other private refineries in Nigeria is about 740,000 barrels per day and in addition to the 445,000 barrels per day capacity of state-owned refineries, the domestic refining capacity of Nigeria could get up to 1.2m barrels daily (Mbachu, 2024).

Niger Delta Region

The Niger delta region is located in the southern part of Nigeria and consists of nine (9) states which are; Rivers, Bayelsa, Abia, Delta, Edo, Akwa Ibom, Cross Rivers, Imo and Ondo states (Yakubu, 2017). The Niger delta is also known as the oil and gas base of Nigeria as all of Nigeria`s crude oil and gas reserves are located there (Yakubu, 2017). Suku et al. (2023) reveals that the Niger-delta houses about thirty-seven billion barrels of crude oil.

The Niger delta is among the most populated regions in Africa and occupies about 70,000 square kilometre (sq km) which is almost 8% of the total land area of Nigeria, the 9 states of the Niger delta have a population of over thirty-one (31) million people (Perri et al., 2022; Yakubu, 2017).

Among the nine Niger-delta states, (6) six are located in the South-South geopolitical region namely Rivers, Bayelsa, Delta, Cross River, Edo and Akwa-Ibom. Two of the Niger-delta states are located in the South-east zone; Imo and Abia and one of the Niger-delta states; Ondo is located in the South-West geo-political zone (Perri et al., 2022). Cross River state is the only non-oil producing state in the Niger-dela region of Nigeria (Ikezam et al., 2021; Perri et al., 2022). Richard et al. (2022) reveals that Akwa Ibom, Rivers, Delta and Bayelsa states alone produce up to 80% of the total crude oil in Nigeria. The Niger delta comprises of about 40 ethnic groups, over 900 oil producing wells which spread over 800 oil producing communities (Richard et al., 2023).

Africa's largest mangrove vegetation and the sixth biggest mangrove vegetation globally is found in the Niger delta (Mezie-Okoye, 2022). One of the greatest concentration of biodiversity globally is located within the Niger delta, this supports plants, animals, trees and freshwater fish species (Richard et al., 2023). The biodiversity also makes available lands that can cultivate a large number of crops. The Niger-delta has two distinct weather conditions: dry season and wet season, dry season is from November till February and there is heavy rainfall from July till September (Richard et al., 2023). Mean temperature in the Niger-delta ranges from about 21◦ to 35◦ and humidity is 50% to 95% through-out the year. The main type of soils in the Niger-delta are: clay, silt and sandy soils, while the major food source in the Niger-delta is from fish and vegetables (Richard et al., 2022).

The Niger-delta is one of the most polluted regions in the whole world, this is due to the oil and gas exploratory activities and is now worsened by artisanal crude oil refining (Richard et al., 2022). Over thirteen million tons of crude oil have been spilled in the Niger-delta since oil exploratory activities began in 1957.

Crude Oil Theft in Nigeria

Bunkering is defined as the legal transfer of a ship loaded with fuel and oil from one shore to another, while illegal bunkering is the unlawful lifting of petroleum products by individuals for their personal use and gain (Chika & Ndidi, 2022). Vandalism of pipelines is defined as the illegal destruction of gas and crude oil pipelines and diversion of products to be sold in the black market. (Chika & Ndidi, 2022). Daily, about 300,000 barrels of

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crude oil are lost in Nigeria due to vandalizing of oil pipelines and stealing of crude oil with most of this crude oil taken to hideouts to be refined illegally (Richard et al., 2022).

This daily stealing of crude oil is making the Country lose billions of dollars in revenue annually. Data from N.E.I.T.I. shows that from 2009 to 2011, the country lost about $10.9bn from crude oil theft and by 2020 the total amount of money lost to stealing of crude oil was put at around $41.9bn (Chika & Ndidi, 2022). Another report shows that in 2011 alone, Nigeria lost about 105bn naira from pipelines theft of crude oil and crude oil products (Ogbuigwe, 2018).

Artisanal Refining of Crude Oil

Artisanal crude oil refining can also be called Illegal crude oil refining, Illegal oil bunkering or kpo-fire (Fyneface et al., 2022). According to Richard et al. (2023), the term artisanal crude oil refining can be used interchangeably with kpo-fire, cooking of crude oil or bush burning. It is the process of illegally converting stolen crude oil into its various components like kerosene, fuel and diesel by burning it (distillation) in hideouts also known as bunkering sites (Fyneface etal.,2022). Artisanal refining of crude oil involves use of few personnel, simple, cheap and locally made materials and technology to refine stolen crude oil (Onakpohor et al., 2020). Artisanal crude oil refining is also been said to be the unlawful processing of crude oil acquired by theft into its components by indigenous people, using locally available resources and skills or technology (MezieOkoye, 2022). Artisanal refineries are made up of 2 tanks lying close to each other and connected by 4 pipes; One of the tanks is the deposit tank that stores crude oil for heating and the second tank is the reservoir tank that receives the refined crude oil products (Adunbi, 2020). According to Richard et al. (2023), artisanal crude oil refining involves three processes: storing crude oil in metallic drums, heating the drums until they get to boiling point and allowing the drums to cool and condense.

The finding of crude oil in the Niger delta has been both a blessing and a curse. While the federal government and oil companies make billions of dollars yearly from crude oil, the Niger delta suffers neglect, marginalization and massive poverty from loss of livelihood which is farming and fishing (Mezie-Okoye, 2022). This loss of livelihood is due to recurrent crude oil spills into the land and water bodies (Ikezam et al., 2021). According to Okolo and Anthony (2019), repeated Crude oil spillage has negatively impacted soil quality and is killing aquatic life in the Niger-delta leading to extensive poverty. Crude oil spill is defined as the *"discharge of petroleum hydrocarbon products into marine or terrestrial ecosystem"* (Ozigis et al., 2019, p.3621). Nigerian Oil Spill Detection and Regulatory Agency (N.OS.D.R.A.) is the government parastatal responsible for capturing oil spills both in land and water using Spectroscopy, while Remote sensing is used to establish the impact of oil pollution (Ozigis et al., 2019).

Reasons For Artisanal Crude Oil Refining in the Niger Delta

The Petroleum Act of 1969 gives the FG complete control of all petroleum resources and does not make provision for Crude oil producing communities to manage their Crude oil resources (Ogele & Egobueze, 2020). Despite the fact that the Niger delta region of Nigeria massively contributes to the Gross Domestic Product of Nigeria, its villages are undeveloped and in poverty and those living in the Niger delta region are among the poorest nation–wide and even in Africa (Mezie-Okoye, 2022). About 70% of the residents in the Niger-delta live below the poverty line and there are almost two million unemployed youths in the Niger-delta (Mezie-Okoye, 2022). Destruction of livelihood (farmlands and aquatic bodies) from oil spills following oil exploration activities have encouraged people living in the Niger-delta to engage in illegal crude oil refining aka Kpo-fire (Okolo and Anthony, 2019). Some scholars have blamed neglect of the Niger-delta by FG and International oil communities as the major cause of proliferation of Artisanal crude oil refining sites in the Niger-delta (Fyneface et al., 2022). Onakpohor et al. (2020), argues that scarcity of refined crude oil products available domestically in Nigeria is a key motivation for illegal crude oil refining. For most communities in the Niger-delta, artisanal refining of crude oil is not seen as a crime but a means of getting their share of the national cake because to them the crude oil does not belong to the FG but to the communities (Adunbi, 2020). The members of community who are involved in artisanal refining of crude oil are perceived as freedom fighters defending the communities from oppression and neglect of the FG and international oil companies and as such their identities are protected by the community (Adunbi, 2020). There are also claims that some security agents and some politicians facilitate artisanal refining

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of crude and this has made it very hard to stop the illegal crude oil refining (Mezie-Okoye, 2022; Richard et al., 2023). Mezie-Okoye (2022) states categorically that artisanal crude oil refining by indigenes of the Niger-delta has not proffered solutions to the poverty, neglect and environmental degradation the Nigerdelta is suffering from but has made the environmental degradation worse.

All Artisanal refineries are Illegal because of the Hydrocarbon Oil Refineries Act of 1965, Number 17 of the Federal Republic of Nigeria which states that "*No person shall refine any Hydrocarbon oils in Nigeria save in a Refinery and under a license issued under this Act*" (Ogele and Egobueze, 2020, p.17).

Environemtal Effects of Aratisanal Crude Oil Refining

Artisanal crude oil refining gravely effects the environment (farm land and water bodies, socio-economic status and health of people living in the Niger-delta (Mezie-Okoye, 2022). As of 2020, there were 20,000 artisanal refining sites in the Nigeria and every one of these refineries negatively affects the environment; water, air and soil (Onakpohor et al., 2020). As of 2023, there were 521 artisanal refining sites in Rivers state, 721 sites in Bayelsa state and 82 sites in Delta state respectively (Richard et al., 2023).

For every two drums of crude oil refined illegally, only one drum of refined products can be gotten and the remaining one drum of crude oil is disposed as waste unto the rivers and land leading to severe environmental pollution

Although there are economic gains of artisanal refining like provision of jobs and reduction of poverty in the Niger delta, its disadvantages far outweigh the gains. The environmental pollution associated with artisanal refining is more severe than that from legal oil exploration and refining in petroleum refineries (Richard et al., 2022). Currently, artisanal crude oil refining is one of the major causes of environmental degradation in the Niger-delta by: releasing of pollutants into the environment during heating of the crude oil and emptying of crude oil onto rivers and land which kills soils and aquatic life (Richard et al., 2022). The heating of crude oil during illegal crude oil refining causes massive air pollution which significantly affects human health. Also, communities where illegal crude oil refining occurs and nearby communities suffer from inhalation of poisonous gases which lead to a number of respiratory illnesses and also acid rain (Richard et al., 2022).

Air Pollution

According to the WHO, air pollution poses the greatest threat to the environment and was responsible for over three million deaths world-wide in 2012 (Yakubu,2017). A number of studies carried out confirm that the Niger-Delta is suffering from serious air pollution and poor quality of air with levels of all air pollutants in the Niger-Delta far above the National and Internationally accepted limits (Yakubu,2017). The air pollutants which have been studied were Carbon monoxide (CO), Sulphur dioxide (SO2), Nitrogen oxide (NO2) and Hydrocarbons. The Niger-delta is one of the most polluted regions in the world and is suffering from a double-burden of air pollution (Yakubu, 2017). This double-burden of air pollution in the Niger-delta is due to: the ever present and extensive air pollution due to Oil and Gas exploratory activities and the appearance of particle pollution from artisanal crude oil refining. The health of people living in the Niger-delta and the environment of the Niger-delta has significantly worsened as a result of this double burden of air pollution

Soot

Soot is a type of air pollution, specifically a particle pollution that significantly endangers public health and the environment (Omisakin, 2020 and Fyneface et al., 2022). The term soot can be used interchangeably with black soot. The term soot is synonymous with a type of particle pollutant and air pollutant known as PM 2.5 (particulate matter 2.5) and it consists of a number of other pollutants which include chemical acids, dust particles and metals (Fyneface et al, 2022). The diameter of soot is 2.5 microns in size, it is smaller than dust and is invisible to naked eyes measuring about one-thirtieth breadth of a human hair (Mezie-Okoye, 2022).

Soot pollution is an emerging type of pollution in the Niger-delta and is responsible for many diseases and deaths among people who get exposed to **it** (Yakubu,2017). The United States Environmental Protection Agency (U.S.E.P.A.) describes soot pollution as one of the greatest dangers to human health and the environment and

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also a major factor driving climate change (Omisakin, 2022). Black soot is currently a very important public health and environmental health issue affecting the Niger delta especially Rivers State (Jack & Zibima, 2020). The main factors blamed for the soot in the Niger-delta are: the presence of numerous artisanal refining sites and the burning of these sites along with the stolen petroleum products by security agents (Fyneface et al., 2022).

Composition And Concentration of Soot in the Niger Delta

Soot consists of impure carbon, formed after incomplete combustion of hydrocarbon containing compounds. Soot contains a number of heavy metals like Lead, Iron, Cadmium, Nickel and Chromium, with levels of Iron highest followed by Lead. According to Kalagbor et al., (2019), the levels of Lead and Cadmium in Port-Harcourt were three times higher than the internationally accepted limits and this led to increased risk of cancers in Port Harcourt. This was collaborated by the International Agency for Research on Cancer which identified Lead and Cadmium as potent carcinogens (Kalagbor et al., 2019). Perri et al., (2022) states that the concentration of soot (PM2.5) in 3 capital cities of Niger delta states namely: Port-Harcourt in Rivers state, Yenagoa in Bayelsa and Asaba in Delta were far above the World Health Organization accepted level of soot which is 10microns/^{m3}. The soot concentration in Port-Harcourt was the highest in the Niger-Delta, this was measured by Remote Sensing from satellite-based Aerosol Optical Depth (A.O.D.) at 550 Nanometres (Perri et al., 2022).

Soot In Port-Harcourt

The first observation of high levels of soot in Port Harcourt was in September 2016 as people living in Port Harcourt were shocked to suddenly see dark fumes and clouds covering the skies and the entire city, this was the onset of the soot menace which lasted for about 2 years (Fienemaka et al., 2018). Kalabor et al. (2019), argues that the soot was first seen in Port-harcourt by November 2019. The soot was seen as a powdery mass of fine black particles that coloured walls, skin and hands of residents of Port Harcourt black after settling down (Fyneface et al., 2022). Plants, clothes and cars were also stained black by the soot and the levels of the soot in Port Harcourt kept rising till about the first quarter of 2017 (Kalagbor et al., 2019). According to Perri et al. (2022), a study carried out in 3 states of the Niger-Delta identified that the concentration of soot was highest in Port-Harcourt. Soot concentration for the study was measured by Remote Sensing from satellite-based Aerosol Optical Depth (A.O.D.) at 550 Nanometres (Perri et al., 2022). Yakubu (2017) states that in February 2017, the Rivers State Government through the State Ministry of Environment established an emergency task force to mitigate the soot menace in Port-Harcourt. The task force released a report indicating that the particulate matter size of the soot in Port Harcourt was 270 microns/m^3 which is by far more than the accepted level of 2.5 microns/m^3 (Jackson & Zibima, 2020).

Soot And Non-Commnunicable Diseases

A plethora of international studies that have been carried out in Europe, Asia and the United States of America have maintained that there is an obvious relationship between exposure to soot (PM2.5) and a number of diseases and even death (Yakubu,2017). When soot is inhaled, it penetrates deeply into the bronchial tissue leading to oxidative stress and irritating the respiratory tract causing cough and injury to the lungs (Mezie-Okote, 2022). The Report of the Rivers State Ministry of Environment investigation into the physical appearance of soot in Port Harcourt was released in 2019. The report showed that about 22,017 residents in Port Harcourt have suffered from Respiratory Tract Infections from 2014 to 2019 and exposure to soot was a risk factor (Omisakin, (2022).

According to Fyneface et al., (2022), soot is among the most important risk factors that leads to respiratory illnesses and skin allergies in Port-Harcourt and the Niger-delta as a whole. Mezie Okoye (2022) states categorically that soot is a hidden danger that is secretly killing people living in the Niger-delta. Soot gets inside the body via: inhalation, ingestion of food which have made contact with soot and absorption by skin (Yakubu, 2017). Exposure to soot is harmful to all persons but people at extremes of age (babies, children and elderly) and those with already existing medical conditions like Diabetes and Cardio-vascular disease are more vulnerable (Yakubu.2017). Perri et al, (2022) showed that increasing prevalence of respiratory illnesses in three states of the Nigher-delta was associated with increasing soot concentrations of the cities studied and vice versa.

Inhalation of soot overtime could lead to Acute bronchitis, worsening of Asthma, Heart attacks and even Cerebro-vascular strokes (Elem, 2021). Mezie Okoye, (2022) adds that, long term exposure to soot can cause

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cancers and coronary artery disease in adults, while being responsible for acute bronchitis, increased severity of asthma and premature death in children. According to Fyneface et al., (2022), some of the effects of long-term exposure to soot are cardiovascular disease, respiratory infections, asthma and cancers of lung, oesophagus and skin. One of the main components of soot is polynuclear aromatic hydrocarbon (P.A.H.) and this is a mutagen; an agent that has ability to change DNA (Fyneface et al., 2022). Exposure to significant concentrations of P.A.H. in-utero can lead to reduced I.Q. levels and increases risk of asthma. Soot is said to be carcinogenic as it contains arsenic, cadmium and chromium which are established carcinogens (Mezie Okoye, 2022). A 2017 study which compared Ibadan a city in South west of Nigeria with no oil and gas exploratory activity and Port Harcourt the centre of oil and gas exploratory activities in Nigeria revealed that the incidence of lung and skin cancers were far higher in Port Harcourt (Yakubu, 2017). Another study in 2019 on soot in Port Harcourt revealed that there is a high incidence of cancers in Port Harcourt and this is attributed to the increased levels of soot residents in Port Harcourt are exposed to (Omisakin, 2022).

Government Initiatives to Combat Illegal Crude Oil Refining, Soot and Environmental Pollution in The Niger Delta

The Federal Government of Nigeria inaugurated the National Oil Spill Detection and Response Agency and the National Environmental Standards and Regulation Enforcement Agency in 2006 and 2007 respectively (Izionworu et al., 2021). Both agencies were set up to tackle the damaging pollution in the Niger-delta.

According to Ubiebi and Ogbonna (2020) over decades, the F.G.N. had established a number of organizations to tackle the under-development and perceived neglect of the Niger-delta. They include: Oil Minerals Producing and Development Commission (O.M.P.A.D.E.C.) in 1992, the Niger Delta Development Commission (N.D.DC.) in 2000 and the Ministry of Niger Delta in 2008. Although these agencies have made some progress, more work needs to be done to reduce unemployment and improve socio-economic status and infrastructure in the Niger-delta. Naevor and Amasuomo (2025) states that the N.D.D.C. replaced the O.M.P.A.D.E.C. and also receives monies from International Oil Companies operating in the Niger-delta for development programs in Niger delta communities.

In 2011, the Federal Government of Nigeria set up the Amnesty programme for militants/freedom fighters in the Niger delta who sabotaged the oil industry by stealing of crude oil, although the amnesty programme was to end a year later it is still running (Adunbi 2020). The militants were encouraged them to surrender their arms and then put on wages and other incentives to discourage them from stealing of crude oil and setting up of artisanal refineries

The Federal government of Nigeria (F.G.N.) also set up the Joint Military Task Force with the aim of combating crude oil theft in the Niger delta (Ogele, 2020). Although the Joint Military Task force have helped in reducing artisanal refineries, they have contributed significantly to the worsening environmental degradation in the Niger delta by burning the discovered artisanal refineries and stolen crude oil despite advocacy by environmentalists against this action. (Mezie Okoye, 2022). In 2014 the Joint Military Task Force burnt down over one hundred and ten (110) artisanal refineries along with the stolen crude oil found in those locations in the Niger delta (Mezie Okoye, 2022). While in 2016 there were over one hundred and eighty-one (181) artisanal refineries burnt down by the military in the Niger delta with millions of dollars-worth of crude oil and products destroyed (Richard et al., 2023). There is ongoing advocacy by National Oil Spill Detection and Regulation Agency (N.O.S.D.R.A.) and National Emergency Management Agency (N.E.M.A.) to the Military Task Force to send the stolen crude oil which has been recovered to the government owned refineries for processing instead of burning them, these suggestions have all fallen on deaf ears with continued burning of recovered crude oil and worsening of the environmental degradation in the Niger delta (Richard et al., 2023).

in 2017 the F.G.N. started the process of setting up 10 modular refineries in the Niger Delta, with the hope of reducing the artisan refining activities going on in the Niger Delta and the consequent harmful effects on people and the environment (Ogbon,2018). The proposal of these modular refineries were part of recommendations by Niger delta stakeholders to the F.G.N. and the aim is to legalize and fund artisanal refineries by converting

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them to modular refineries which are legal (Elem,2021). The modular refineries are a legitimate business carried out through proper technical, commercial and environmental regulations. Setting up of the modular refineries would also provide economic empowerment to citizens of the Niger Delta as youths especially those previously involved in artisanal refining will be employed, the scarcity of refined petroleum products in Nigeria because of the poor refining capacity of its 4 refineries will also be addressed (Ogbon et al., 2018). Finally, the modular refineries will help improve crude oil exportation which will boost the earnings and economy of the country (Ogbon et al., 2018).

The Petroleum Industry Bill (P.I.B.) was sent by the National assembly to President Buhari and was signed into law in 2021 as the Petroleum Industry Act (P.I.A.) (Borha and Olujobi, 2023). The P.I.A. replaced the Petroleum Act of 1969 which had become outdated, did not provide enough sanctions to defaulters and was not able to handle the concerns of oil and gas producing communities. The P.I.A. was intended also to help the Nigerian government get up to forty billion barrels of reserves and four million barrels per day of crude oil production. According to Naevor and Amasuomo (2025), the P.I.B, was debated in the national assembly for about 20 years before being passed and sent to President Buhari to sign into law as the P.I.A, its major purpose was to help solve the problems in the Nigerian oil and gas sector. The P.I.A. led to the set-up of two new agencies in the oil sector: the Nigerian Upstream Petroleum Regulatory Commission (N.U.P.R.C.) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (N.M.D.P.R.A.) (Naevor and Amasuomo, 2025). These 2 agencies are empowered by law to regulate petroleum activities in the upstream, midstream and downstream. From the P.I.A. act, the Petroleum Host Communities Development Trust Fund was established and oil companies are to pay three percent of their yearly operating expenditure to this trust fund as compensation to oil and gas producing communities. Naevor and Amasuomo (2025) argued that the oil producing communities should be better informed of the P.I.A. contents and that the three percent being paid to the trust fund be increased to ten percent

Recommendations For Tackling Artisanal Crude Oil Refining and Soot Production

A first of its kind community to community enlightenment and advocacy program for oil and gas producing communities in the Niger delta. This will involve data on rising prevalence of morbidities and mortalities associated with respiratory illness and cancers in the Niger-delta. This will be important because people living in oil and gas communities need to be aware that soot is a silent killer and also harmful to unborn babies and that the gains from artisanal crude refining cannot be compared to the negative impact on their health. Whereas the P.I.A. encourages community effort in protecting crude oil, crude oil related infrastructure and reducing artisanal refining through financial incentives to communities. This proposed community to community enlightenment program will complement the P.I.A. by focusing on community mobilisation and cooperation to tackle artisanal refining based on the importance of protecting and promoting their health of members of the community.

There should be advocacy to national assembly, Federal government and Joint military task force on the dangers of burning recovered crude oil and artisanal refineries when they are discovered by security agencies. This will help protect the environment as burning of crude oil and artisanal refining sites is massively polluting the Niger-delta environment. The recovered crude oil can be taken in tanks to be stored in official refineries for refining.

Federal government is encouraged to provide specific amnesty for people involved in artisanal refining of crude oil and legalise their activities. With proper supervision and focus on environmental health and human health, there can be a transit from artisanal refining to modular refineries.

Continuous advocacy to intervention agencies set up for the Niger-delta like N.D.D.C. commending them on their efforts in tackling poverty, unemployment and improving human capital and infrastructural development and encouraging them to implement more specific and impactful projects in the Niger-delta communities. Intervention agencies operating in the Niger-Delta should also be encouraged to involve members and leaders of communities in choosing the types of projects needed and their location. This will make people living in the communities begin to feel impact of the government and benefits of the crude oil in the communities.

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CONCLUSION

The Niger-delta is the oil and gas base of Nigeria and has almost all crude oil reserves of Nigeria. the Niger-Delta has been suffering from decades long neglect, poverty and environmental pollution from oil and gas exploration. These factors have made residents of the Niger-delta engage in illegal crude oil refining to make available refined products and to economically empower themselves as its seen as a compensation. The illegal crude oil refining produces soot which is harmful to humans and the environment and has worsened environmental degradation. Exposure to soot also is a big risk factor for many respiratory illnesses and cancers. Currently, there is an increase of respiratory illnesses in the Niger-delta and exposure to soot is implicated. A number of suggestions to tackle the soot menace in the Niger-delta have been discussed and they include: advocacy to government and military to stop burning of recovered crude oil and artisanal refining sites, advocacy to intervention agencies to embark on specific and impactful programs in Niger-delta communities.

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