

ENVIRONMENT EFFECT OF KPO-FIRE IN NIGER DELTA AND FUTURE HEALTH IMPLICATION

Abstract

The discovery of crude oil in Niger Delta which includes Bayelsa, Delta, Rivers, Abia, Akwa-Ibom, Cross River, Edo, Imo and Ondo States of Nigeria, has led to significant economic growth of the nation especially in the creation of job opportunities and generation of revenue. Unfortunately, Oil thefts have become the idea that replaced the agitations in the Niger Delta communities against the perceived neglect of the areas. This had resulted to widespread operation of illegal oil bunkering activities called Kpofire. Kpofire, in local Niger Delta parlance, is the process of hitting crude at makeshift locations called bunkering sites or dumpsites by illegal oil operatives or oil thieves to extract refined petroleum products. The design for the extraction of the petroleum products involves a steaming section and a collection part. The two sections are linked by a very long pipe. Heat is applied to the steaming section using mangrove wood called 'Ngala' or 'Agala' thereafter crude oil is used. The products extracted are fuel, kerosene and diesel. One of the major problems of Kpofire is the introduction of black soot into the environment. Soot represents the unwanted by product from relatively uncontrolled incomplete combustion or pyrolysis of carbon-containing materials. Polynuclear aromatic hydrocarbon (PAH) molecules are the dominant component of soot. The people of the region are currently faced with several environmental challenges ranging from poor health conditions, inadequate housing facilities; contaminated drinking water sources, barren lands for agriculture, and dead rivers for fishing activities. Black soot, which is gradually becoming a persistent challenge in many Niger Delta communities, has been linked to the upsurge in adverse respiratory, skin, and reproductive health conditions. However, babies and children (particularly due to their premature respiratory organs), the elderly, and people with preexisting health conditions, including heart or lung diseases (such as asthma) are more vulnerable. High prenatal PAH exposure is connected to a low IQ and increased behavioral problems in the early-age child and childhood asthma. A collective effort is needed to stop this menace called kpofire to avoid endangering the environment and the health of the people of Niger Delta.

Keywords: *Kpofire, Niger Delta, oil bunkering, soot*

1.0 Introduction

Our environment is the sum total of all the living and non-living elements and their effects that influence human life. Our environment offers resources for production which includes both renewable and non-renewable resources. Petroleum is one important non-renewable resource that our environment has provided. Petroleum, also known as crude oil, is a naturally occurring, yellowish-black liquid found in geological formations beneath the Earth's surface. It is commonly refined into various types of fuels. Components of petroleum are separated using a technique called fractional distillation, that is, separation of a liquid mixture into fractions

differing in boiling point by means of distillation, typically using a fractionating column. Once extracted, oil is refined and separated, most easily by distillation, into numerous products for direct use or use in manufacturing, such as gasoline (petrol), diesel and kerosene to asphalt and chemical reagents used to make plastics, pesticides and pharmaceuticals. Petroleum is used in manufacturing a wide variety of materials. Petroleum production can be extremely profitable and was important for economic development in the 20th century, with some countries, so called "oil states", gaining significant economic and international power because of their control of oil production. Nigeria had been an agrarian (agricultural) economy, which accounted mostly for its export earnings from the late 50s to early 70s before the exploration of oil in commercial quantities. Crude oil was discovered in Nigeria in 1956 in Oloibiri. This discovery was made by Shell D'arcy Petroleum Development Company of Nigeria, a consortium of Shell and British Petroleum then known as Anglo-Iranian. Crude oil has been widely used in Nigeria and has offered the nation much advantage. It has led to significant economic growth of the nation especially in the creation of job opportunities and generation of revenue. All of the crude oil in Nigeria comes from numerous, small producing fields, located in the swamps of the Niger Delta. Unfortunately, Oil thefts have become the idea that replaced the agitations in the Niger Delta communities against the perceived neglect of the areas. Illegal oil bunkering or oil theft has made oil spillages and explosions a common occurrence in the Niger Delta region (Campbell, 2015). The consequences of some of these spills are already very conspicuous, as United Nations Environment Program (UNEP) discovered in their environmental assessment of Ogoniland in Rivers State that oil contamination had destroyed mangroves, polluted soil and groundwater, killed the fishes in the streams and rivers, and represented a genuine danger to general wellbeing (UNEP, 2011). The people of the region are currently faced with several environmental challenges ranging from poor health conditions, inadequate housing facilities; contaminated drinking water sources, barren lands for agriculture, and dead rivers for fishing activities.

This study is exclusively based on secondary data that are sourced from textbooks, journals, articles, magazines, newspapers, newsletters, and interviews.

2.0 Study area

Niger Delta is located in the southern coast of Nigeria. It is a major geomorphic feature in Nigeria coastal zone. It stretches from the Benin river estuary for about 450km eastward and terminates at the mouth of Imo river estuary. It consist of major distinct ecological zones such as the fresh water, swamp mangrove, creeks, estuaries and barrier island (Ukong, 2009).

The Niger Delta, as now defined officially by the Nigerian government, extends over about 70,000 km² (27,000 sq mi) and makes up 7.5% of Nigeria's land mass. Historically and cartographically, it consists of present-day Bayelsa, Delta,

and Rivers States. In 2000, however, Obasanjo's regime included Abia, Akwa Ibom, Cross River State, Edo, Imo and Ondo States in the region (Otoabasi, 2011).



Image :1 Map of Niger Delta Region Showing the States. (Source: nairametrics.com)

3.0 Kpo-fire

Kpo-fire, in local Niger Delta parlance, is the process of hitting crude at makeshift locations called bunkering sites or dumpsites by illegal oil operatives or oil thieves to extract refined petroleum products. It is simply a local oil process of heating the crude in fabricated oven to extract petroleum products. It is also a local word used to describe fire incident that occurred during illegal refining of crude oil or breakage of fuel pipe line. It is also considered as the local name for illegally refined products gotten from illegal oil bunkering activities.

4.0 Production process

The design for the extraction of the petroleum products involves a steaming section and a collection part. The two sections are linked by a very long pipe. The drum used for the boiling of crude is about 15mm thick constructed by welders. The pipe linking the boiler and the collector drum is about 72 to 90 feet long and about 16mm thick. The drum for collection is 15mm thick with no lid. The length of the pipe is necessary to reduce the magnetic power of fuel and kerosene. The initial fire is started using mangrove wood called 'Ngala' or 'Agala' thereafter crude oil is used (Daminabo *et al.*, 2017).

The boiling point of each fraction is not known. The first product that comes out is identified by its smell and colour as fuel. The second product that follows has lighter colour and by its smell, is identified as kerosene. The last of the product which is dark green and also by its odour is identified as diesel. At the end of each distillation, a pumping machine is used to transfer the product to another container where it is allowed to cool.

5.0 Soot

One of the major problems of Kpo–fire is the introduction of black soot into the environment. Soot represents the unwanted by product from relative ly uncontrolled incomplete combustion or pyrolysis of carbon-containing materials (Omidvarborna *et al.*,2015). Thus, soot may be derived from waste oil, fuel oil, gasoline fuel, diesel fuel, coal, wood, paper, rubber, plastics and resins or household refuse. These various materials are burned to produce heat or energy in domestic fireplaces, domestic furnaces, industrial furnaces, and vehicle engines. The black soot in this region is generated as a result of illegal refining of crude oil. Some other factors said to be responsible for generation of soot include the burning of seized stolen crude by security operatives and setting ablaze crude oil sites by some oil contractors in the industry, all in the name of cleanup. Soot is a pseudonym for a type of particle pollution called PM 2.5, an air pollutant comprising a variety of other pollutants like chemical acids, metals and dust particles. The particle has diameters that are 2.5 micrometers or less. And consist of varying amounts of carbon, organic compound, resins, and inorganic materials. Soot forms as a result of incomplete combustion. To achieve incomplete combustion instead of complete combustion, the fuel must burn at a lower temperature with a slightly reduced supply of oxygen. When the fuel burns, it breaks into small particles that include soot, which settles out as a dark powdery deposit (ACS, 2013).Soot in very low concentrations is capable of darkening surfaces or making particle agglomerates, such as those from ventilation systems, appear black. Soot is the primary cause of "ghosting", the discoloration of walls and ceilings or walls and flooring where they meet.

Polynuclear aromatic hydrocarbon (PAH) molecules are the dominant component of soot, with individual PAH molecules forming ordered stacks that agglomerate into primary particles (PP). Because of the high thermodynamic stability of polynuclear aromatic hydrocarbon (PAH) molecules, these species have been identified in crude oil (including asphaltenes), are persistent organic pollutants present in many environmental soil and sediment samples, and are thought to be the source of infrared (IR) emission bands associated with many interstellar environments (Buseck *et al.*, 2012).



Figure 1: Atmospheric condition in Niger Delta on a moderate soot day. (Ibira, 2022)



Figure 2: Atmospheric condition in Niger Delta on a high soot day. (Ibira, 2022)



Figure 3: Burning tanks containing illegally refined crude products in Rivers state (Ibira, 2022).

6.0 Environmental Effects of Kpo-fire

Environmental pollution is one of the most serious issues confronting human society today. The three basic areas of environmental pollution are air, water, and soil. Environmental pollution occurs when there is an unfavourable change in the environment that has a negative impact on plants and animals.

Oil pollution by crude oil and its by products as a result of illegal ("Kpo-fire") crude oil refining is one of the most common environmental challenges in the Niger Delta. It was observed in a study that the higher the concentration of the residue (soot), the more the effect on the fungal population and diversity. The decrease in species composition and the fungal populations observed are indicative of the effect of the illegally refined crude oil residue on the soil fungal population and diversity. Hence, agricultural product and its quality can be affected. The continual dumping of this residue into the soil environment, will in turn affect the ecological balance, since these organisms play very important role in the ecosystem (Douglas, 2018).

Soot in very low concentrations is capable of darkening surfaces or making particle agglomerates, such as those from ventilation systems, appear black. Soot is the primary cause of "ghosting", the discoloration of walls and ceilings or walls and flooring where they meet.

Soot also tends to form in chimneys in domestic houses possessing one or more fireplaces. If a large deposit collects in one, it can ignite and create a chimney fire. Regular cleaning by a chimney sweep should eliminate the problem. Soot, particularly diesel exhaust pollution, accounts for over one quarter of the total hazardous pollution in the air (Omidvarborna *et al.*, 2014)

7.0 Future Health Implication

As said earlier, soot is a byproduct of the incomplete burning of organic (carbon-containing) materials, such as wood, fuel oil, plastics, and household refuse. The fine black or brown powder that makes up soot may contain a number of carcinogens, including arsenic, cadmium, and chromium.

Exposure to soot was first associated with skin cancer of the scrotum among British chimney sweeps in 1775. Since then, many studies have found that chimney sweeps have an increased risk of scrotal and other skin cancers. Studies of chimney sweeps in several European countries have also found associations with other cancers, including lung, esophageal, and bladder cancers. People may be exposed to soot by inhalation, ingestion, or absorption through the skin (IACR, 2012).

Lifetime inhalation of high concentrations of black soot had been found to be capable of causing lung tumors in Rats. However, these studies were conducted to evaluate the role of mutagenic organic material in the induction of lung tumors. Black soot, which is gradually becoming a persistent challenge in many Niger Delta communities, has been linked to the upsurge in adverse respiratory, skin, and

reproductive health conditions. A 2019 report showed that black soot-related health disorders were responsible for about 25,000 deaths in the region.

Long-term exposure to urban air pollution containing soot increases the risk of coronary artery disease. (Kristin *et al.*, 2007)

The PAHs in soot are known mutagens. a mutagen is a physical or chemical agent that permanently changes genetic material, usually DNA, in an organism and thus increases the frequency of mutations above the natural background level. Mutagens can cause changes to the DNA and are therefore genotoxic. They can affect the transcription and replication of the DNA, which in severe cases can lead to cell death (Buseck *et al.*, 2012; Rundel, 2001)

Soot can have adverse health consequences on population health, however, babies and children (particularly due to their premature respiratory organs). The elderly, and people with preexisting health conditions, including heart or lung diseases (such as asthma) are more vulnerable (WHO, 2017).

In recent times, there has been reported cases of physiological effects recorded in areas with intense gas flaring and these effects include birth defects which occur during the reproductive cycle of women in their first trimester of pregnancy (Gobo *et al.*, 2010).

Telomere length was found to be shortened in workers exposed to polycyclic aromatic hydrocarbons (PAHs) and influenced by individual genetic variations in telomere-binding proteins (Duan *et al.*, 2020.) Shortened telomeres impair immune function that might also increase cancer susceptibility (Eisenberg, 2011). Telomere shortening is associated with aging, mortality and aging-related diseases. High prenatal PAH exposure is connected to a low IQ and increased behavioral problems in the early-age child and childhood asthma (Perera *et al.*, 2014; Rengarajan *et al.*, 2015).

Conclusion

This is clear that the environments and the health of the people of Niger Delta are in a serious danger if measures are not put in place to stop activities that caused production of soot. And provide a remedy system to cushion the damages and the future effects on the environment and the health of occupants of the Niger Delta environ. The constituent of soot are very lethal to human as it is capable of causing health conditions like skin, esophageal, and bladder cancers, heart or lung diseases etc. The continual release of this residue into the soil environment, will affect the ecological balance, since it has the ability to kill soil microorganisms. These organisms play very important role in the ecosystem.

References

- American Chemical Society. (2013). "Methane and oxygen react". Internet: <http://www.middleschoolchemistry.com/multimedia/chapter6/lesson1>, [October 25,
- Buseck, P. R., Adachi, K., Gelencsr, A & Tompa, M. P. (2012). Are black carbon and soot the same? *Atmospheric Chemistry and Physic Discuss*, 12, 24821 – 24846.
- Campell, J. (2015). A Primer on Nigeria's Oil Bunkering. Council on Foreign Relations. <https://www.cfr.org/blog/primer-nigerias-oilbunkering> (Retrieved 10th March, 2022)
- Daminabo, C. A. , Ibiene, A. & Chinago, B. A. (2017). KPO-Fire: The Effect of Unharnessed Technology in Niger Delta, South - South Nigeria. *Journal of Resources Development and Management*, 34, 20-32
- Douglas, S. I. (2018). Effect of Illegally Refined Crude oil ("kpo- fire") Residue on Soil Fungi. *International Journal of Current Microbiology and Applied Sciences*, 7(12), 3309-3316
- Duan X, Zhang D, Wang S, Feng X, Wang T, Wang P, Ding M, Zhang H, Liu B, Wei W, Acquaye RM, Yao W, Cui L, Zhou X, Wang W, Yang Y. Effects of polycyclic aromatic hydrocarbon exposure and miRNA variations on peripheral blood leukocyte DNA telomere length: A cross-sectional study in Henan Province, China. *Sci Total Environ*. 2020 Feb 10;703:135600. doi: 10.1016/j.scitotenv.2019.135600. Epub 2019 Nov 18. PMID: 31767308.
- EIA Energy Kids – Oil (petroleum). (2017). www.eia.gov. Archived from the original on July 7, 2017. Retrieved March 10, 2022..
- Eisenberg, D. T. (2011). An evolutionary review of human telomere biology: the thrifty telomere hypothesis and notes on potential adaptive paternal effects. *American Journal of Human Biology*. 23 (2), 149–67.
- Gobo, A., Richard, G. & Ubong, I. (2010). Health Impact of Gas Flares on Igwuruta/Umuechem Communities in Rivers State. *Journal of Applied Science and Environmental Management*, 13, 27–33.
- Ibira, R. (2022). Condition of Port Harcourt on a soot day. Legend'13. <https://m.facebook.com/groups/164347860422971/permalink/1825508940973513/>
- International Agency for Research on Cancer (IARC) 2012. Soot, As Found In Occupational Exposure of Chimney Sweeps, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 100F. Lyon, France: World Health Organization, 2012.
- Kristin, A. M., David, S. S., Lianne, S., Kristen, S., Jeffrey, H. S., Garnet, L. A., & Joel, D. (2007). Kaufman Long-Term Exposure to Air Pollution and Incidence of Cardiovascular Events in Women, in *New England Journal of Medicine* , 356(5):447-58.

Nairametrics, (n.d). Map of Niger Delta Region. <https://nairametrics.com/>

Omidvarborna, H. & AshokKumar, D. (2015). "Recent studies on soot modeling for diesel combustion". *Renewable and Sustainable Energy Reviews*. 48: 635–647.

Omidvarborna, H., Ashok, K. & Dong-ShikKim. (2014). "Characterization of particulate matter emitted from transit buses fueled with B20 in idle modes". *Journal of Environmental Chemical Engineering*. 2 (4): 2335–2342.

Otoabasi, A. (2011). *The Niger Delta Question and the peace plan*. Spectrum Books.

Perera, F.P., Chang, H.W., Tang, D., Roen, E. L., Herbstman, J., Margolis, A., Huang, T.J., Miller, R.L., Wang, S. & Rauh, V. (2014). Early-life exposure to polycyclic aromatic hydrocarbons and ADHD behavior problems. *PLoS One*, 5,9(11):e111670.

Peter Valberg 2001, AIHAJ - American Industrial Hygiene Association

Rengarajan, T., Rajendran, P., Natarajan, N., Lokeshkumar, B., Palaniswami, R. & Nishigaki, I. (2015). Exposure to polycyclic aromatic hydrocarbons with special focus on cancer. *Asian pacific journal of tropical biomedicine*, 5(3): 182-189

Rundel, R. (2001). Polycyclic Aromatic Hydrocarbons, Phthalates, and Phenols, in *Indoor Air Quality Handbook*, John Spengleer, Jonathan M. Samet, John F. McCarthy (eds), pp. 34.18-34.21, 2001

Ukpong, I.E. (2009). *Perspective on Environmental Management*. Environmental System Club INC. Uyo, Akwa Ibom Nigeria.

UNEP, (2011). *Environmental Assessment of Ogoniland*. Nairobi, Kenya: United Nations Environment Programme;
Available:http://postconflict.unep.ch/publications/OEA/UNEP_OEA.

World Health Organization (WHO). *Air Pollution*. Available online:
<http://www.who.int/ceh/risks/cehair/>