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Environmental Risk of Gas Flaring In Nigeria: Lessons from Chevron Nigeria and Ilaje Crisis

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Abstract

Environmental risk concerns that risks that have adverse effects on the environment and people. In another context, gas flaring is mainly used to dispose of associated gases with crude oil to make it more economically useful; and this has been regular practice within the Nigerian oil and gas industry for decades. This research fundamentally addresses environmental risk of gas flaring on the environment and people living within the Niger Delta region of Nigeria using Chevron and Ilaje crisis as case-study. The research reveals the health and safety implications of gas flaring in Nigeria and lessons for different stakeholders. The hydrocarbon compounds such as benzene, naphthalene, styrene, toluene, and xylene found in the flaring of associated gas affect health and safety of the local people in Nigeria. For example, we found that breathing particulate matter which are linked to gas flaring result into aggravated asthma, increase in respiratory symptoms like coughing and difficult breathing, chronic bronchitis, decreased lung function, and premature death; and also found that health issues such as pneumonia and cases of leukaemia are linked to gas flaring. The results also show that carbon dioxide emissions in the Niger Delta region of Nigeria ranked among the highest in the world. Our findings bear vital implication for gas flaring elimination projects in Nigeria and reveal shortcomings in the current oil and gas industry practice in which it is cheaper to flare gas than to eliminate it. In conclusion, the study recommends best fit approach to build trust among stakeholders and reflect upon the research limitations and issues were raise for future research consideration.

Keywords: Environmental risk, risk management, gas flaring, climate change, Ilaje, Niger Delta, Nigeria

1. INTRODUCTION

The fundamental aim of this research is to explore the environmental risk of gas flaring in Nigeria using lessons from the Chevron and Ilaje crisis. We used the concept of "flaring and slaying" in this research to demonstrate the potential consequences of gas flaring on the environment and stakeholders in Nigeria especially Ilaje Local Government Area of Ondo State. For example, research has shown that gas flaring continue unabated in Nigeria which produce as much carbon dioxide as two million cars yearly; and several studies have revealed the devastating effects on the local people and environment in Nigeria (e.g. Mafimisebi, 2013; Nkwunonwo & Mafimisebi, 2013; Mafimisebi & Nkwunonwo, 2014; 2015; Mafimisebi & Thorne, 2015; 2016). Therefore, this research discusses the health and safety implications including the applicable legislations in Nigeria. Again, the key challenges of environmental risk and the implications on Chevron Nigeria is also discussed. In addition, the study shall reveal possible environmental risk strategies in order to effectively manage the risk.

In this paper, gas flaring is considered as an environmental aspect because it causes atmospheric emissions. It is one of the major environmental concerns in the Niger Delta region of Nigeria (Bassey, 2008; Aghalino, 2009; Mafimisebi & Nkwunonwo, 2014; Mafimisebi & Thorne, 2015; 2016; Ovuakporaye, 2012). One question central to this research is what impacts might gas flaring have on the environment and stakeholders in Ilajeland, Ondo State, Nigeria? Extant research found that noise pollution, itching and skin rashes, the discomfort generated by the light from constant gas flaring in Nigeria including the black dust and soot that settle in people's homes (Figure 3 – 8) and on food and clothes undermine quality of life and make local people more vulnerable to health problems. This informs the choice for using Chevron as a case study because of its unending gas flaring activities in Ilaje Local Government Area of Ondo State, Nigeria. It is expedient to note that gas flaring in Nigeria is as old as the inception of oil exploration in 1956 (Mafimisebi & Nkwunonwo, 2014; Ologunorisa, 2001, p. 249). In this research, we have used the term "Ilajeland" to refer to Ilaje Local Government Area of Ondo State.

In this research, environmental risk concerns the risks that could have adverse effects on the environment and people (Mafimisebi & Nkwunonwo, 2015; Morrison, 2006) and there are several environmental legislative instruments in Nigeria which regulate all activities that impact the environment. The principal legislations include the Federal Environmental Protection Agency (FEPA) Act 1988 and National

Environmental Standards and Regulation Enforcement Agency (NESREA) Act 2007 (Ogbodo, 2009). However, other relevant environmental legislations in Nigeria are summarized in the register of applicable environmental legislation (Table 1). So what impact do environmental legislations have on organisations and environment in Nigeria? And how effective are these legislations? These questions require extensive review and vast empirical data to appropriately answer them and as such we have not attempt to include responses to the questions in this current paper. The rest of this work discusses the impacts of gas flaring on the environment and stakeholders within Ilajeland, Ondo State, Nigeria.

TABLE 1: REGISTER OF APPLICABLE ENVIRONMENTAL LEGISLATION IN NIGERIA

Ref. No.	Legislation Title	Purpose/Scope	Compliance Requirements/Status	Review and Monitoring
ENL 1	The Petroleum Act 1969	The Act deals mainly with business regulation of the petroleum industry and contains only little on pollution prevention	The Act requires business to be conducted in a vigorous and business-like manner and in accordance with good oilfield practice	Regularly to check compliance level. Although the Act did not explicitly explain what business-like mean especially in relation to environmental pollution.
ENL 2	The Petroleum (Drilling and Production) Regulations	Regulation 25 provides that the licensee or lessee shall adopt all practicable precautions including the provision of up-to-date equipment as approved by the Director of Petroleum Resources, to prevent pollution	The Regulations obligate an operator to pay adequate compensation to any person whose fishing rights are interfered with by the unreasonable exercise of the operator's rights	Regular review as Chevron may be liable.
ENL 3	Mineral Oils (Safety) Regulations	The Regulation deal with safety concerns in the oilfield.	The company need constant review as the safety of employees is concern	Regular review and monitoring of any changes
ENL 4	Petroleum Refining Regulation	It requires a refining company to adopt 'all practical precaution' and prevent pollution of the environment by petroleum or petroleum products, and where such pollution occurs, to take prompt steps to control, and if possible, end it.	The company may be liable for harm cause to the environment as a result of its gas flaring activities	Regular review and monitoring
ENL 5	Federal Environmental Protection Agency Act, 1988	It established FEPA as the implementing authority with responsibility, among others, to establish environmental criteria, guidelines, and standards for the protection of the nation's air and interstate waters as may be necessary to protect the health and welfare of the population from environmental degradation.	The company would require constant environmental risk assessment to determine significance so as not to be liable	Require regular review and up to date information on further guidelines
ENL 6	National Environmental Protection (Pollution Abatement in Industries Generating Wastes) Regulations	This Regulation also directly affects the companies within the Nigerian oil and gas industry. Regulation 1 states that no industry or facility shall release 'hazardous or toxic substances into the air, water or land of Nigeria's ecosystems beyond limits approved by FEPA.	This regulation has implication on the company activities. The need for compliance and monitoring of any changes is then important	Regular review and monitoring
ENL 7	Oil Pipelines Act 1956	Section 11 (5) provides, in part, that the holder of a licence shall pay compensation… to any person suffering damage (other than on account of his own default or on account of malicious act of a third person)	The company would have to check constantly to review activity such that it's not liable under the Act	Regular review and monitoring.

		as a consequence of or leakage from the pipeline or an ancillary installation.		
ENL 8	Environmental Impact Assessment Decree No. 86 of 1992	The law aims at protecting the environment. It is particularly directed at regulating the industrialization process with due regard to the environment	The company would need to ensure compliance level. The law mandated company to carry out an environmental evaluation assessment on already polluted or impacted environment. The company would have to check this requirement.	Regular review of the level of compliance.
ENL 9	The Department of Petroleum Resources (DPR) Environmental Guidelines and Standards (EGAS) of 1991	The guidelines is for the petroleum industry and a comprehensive working document with serious consideration for the preservation and protection of the Niger Delta, and thus the Nigerian environment, in the course of searching for and producing crude oil.	The level of compliance on oil company is mandatory just like other laws. The company would need to check for any changes in the standards	Check for any changes and the level of compliance.
ENL 10	National Environmental Standards and Regulation Enforcement Agency (NESREA) Act 2007	The Act established the National Environmental Standards and Regulations Enforcement Agency. The protection of the environment is the principal aim of this law.	Oil companies like Chevron need to ensure that their activities are in compliance with the requirement of the law.	Regular review and monitoring.
ENL 11	Health and Safety at Work etc. Act 1974	Regulate the health and safety of the employees and other persons as defined in the Act.	The company may have to check provision for the level of compliance with the relevant requirements.	Regular and constant monitoring of the company activities in terms of health and safety.
ENL 12	Associated Gas Re-Injection Decree 1979 and its 1984 amendment	Regulate and banning gas flaring within Nigeria and imposed fines for non-compliance	The company would have to end gas flaring as soon as possible. This would reduce cost spent on fines.	Regular monitoring of any changes in the provisions of the law.

2. CASE STUDY OF CHEVRON AND ILAJE CRISIS IN ONDO STATE, NIGERIA

The area for the study was Ilaje Local Government Area, Ondo State, Nigeria. The Ilajeland is situated in the Southern part of Ondo State. The local government comprises of predominantly fishing communities along the Atlantic Ocean. The Local Government Area has the longest coastline in Nigeria (approximately 78km) with long history in fishing as far back as the pre-colonial days in 1909. Thus, fishing constitutes the major source of income for the people. The Ilaje people speak a native dialect called 'Ilaje' though a sub-dialects within the broader Yoruba Language. The native of the local government are called Ilaje. There are over 82 fishing communities within the coastline and the Ilaje are the major producer of fish in Ondo State (Samsons, 1995). Chevron is the main oil company operating within the Ilaje Local Government Area of Ondo State, Nigeria (Fatusin, Afolabi & Adetula, 2010, p. 189). Chevron Nigeria Limited (then Gulf Oil) is the third-largest oil producer in Nigeria and one of its largest investors, spending more than $3 billion annually (Chevron, 2012). The company had its first oil field in Ilajeland, Ilaje Local Government Area (Niger Delta Region), Ondo State, Nigeria in November, 1968 at Meren Oil Field. Consequently, operations seems to have spread to other oil fields such as Parabe and Malu oil fields in February and March 1971, Opuekeba flow station in October 1993, the Esan oil field in February 1997, and the Opolo and Ewan oil fields in March 1997, and some other oil fields that were later returned to Ilaje such as Tsekelewu.

Ilajeland is located along the Atlantic coast of Nigeria between longitude $4^{o}28'$ and $5^{o}1'$ east of the Greenwich Meridian and latitude $5^{0}51'$ and $6^{0}21'$ north of the Equator (Ololajulo, 2009, p. 4), (see, figure 1 – 8). According to the 1991 National Population Census, Ilaje Local Government has a population figure of two hundred and seventy seven thousand and thirty four (277,034) people. Empirical evidence shows that crude oil was first discovered in Nigeria at Araromi, Ilajeland in 1908 and Ogogoro in 1952 even before its commercial discovery at Oloibiri in Bayelsa State, Nigeria. Ilajeland is predominantly fishing communities with more over 90 per cent of the people involved in fishing directly or indirectly within the Ilaje Local Government Area of Ondo State, Nigeria. Therefore, it is not surprise to see how gas flaring within these communities would not

affect the people and their source of livelihood.

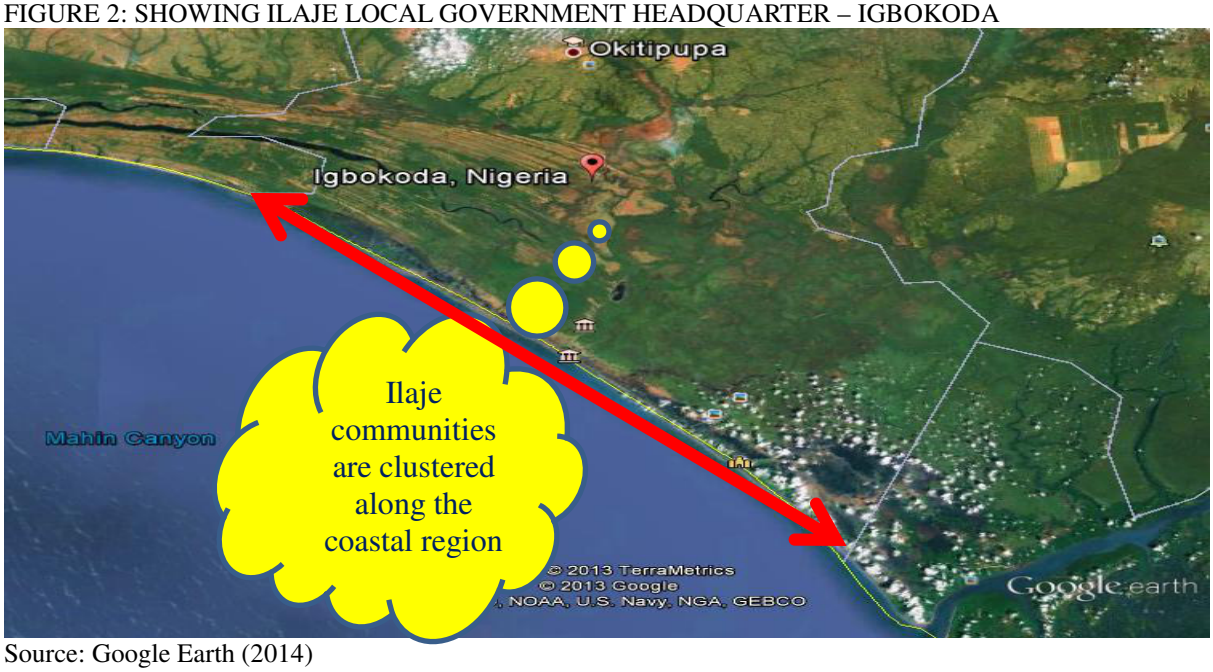
However, seventeen different gas flaring stations within Ilajeland were captured for this research (see Figure 1 – 8). These include Meren, Parabe, Malu, Isan, Opolo, Ewan, Opuekeba, Okagba, Tapa, Mejo, Omuro, Ojumole, Opuama, Bella, Eko, Obe and Tsekelewu oil fields. In all these flow stations, there are frequent oil and gas activities including gas flaring which make the local people and the environment vulnerable to impending disasters. These oil and gas activities arguably harm the environment and have adverse effects on human health within the area. It is unlikely that Ilaje people did recognized the potential impacts of gas flaring until this environmental insecurity and injustice was expressed in a memo to the Ondo State Military Administrator in 1998 (The Concerned Ilaje Citizens, 1998). Chevron operation which started in Ilajeland in November, 1968 with the first oil field at Meren is argued to have caused extreme environmental degradation. Specifically, in 1998, local communities' youths in Ilaje protested against Chevron Nigeria operations for devastating the environment through unending gas flaring and oil pollution and taken away sources of livelihood (fishing and farming). The response of Chevron to the protest was widely criticized as the organisation brought in Nigerian military as well as the police to brutally attack the unarmed protesters. The legal case of Bowoto Vs Chevron Corporation reveals the extent of the damages inflicted on local people and most of them still do not get compensation.

FIGURE 1: SHOWING ONDO STATE (IGBOKODA, NIGERIA) WITHIN NIGERIA MAP

Source: Google Earth (2014)

The map in figure 1 shows Ondo State within Nigeria map. It also shows Igbokoda. Igbokoda is the Local Government Headquarter of Ilaje Local Government Area. The local governments headquarter houses the administrative functions and management of the council. It is thus significant to Ilajeland as a whole.

FIGURE 2: SHOWING ILAJE LOCAL GOVERNMENT HEADQUARTER – IGBOKODA



Source: Google Earth (2014)

The map in figure 2 shows the position of Ilaje Local Government Area with Igbokoda being the Headquarter. With exceptions of a few communities within the Ilaje Local Government Area, over 90% of other communities are located along the coastal line as indicated with the red arrow on the map. These local communities house the gas flaring stations of Chevron. In some cases, flaring stations are located a few meters away from communities, even, with local just within the communities.

FIGURE 3: SHOWING OLOKOLA WITHIN THE ILAJE LOCAL GOVERNMENT AREA

Source: Google Earth (2014)

Figure 3 shows Olokola within the Ilaje local government area. Again, it is important to mention that Olokola is significant also within Ilajeland. It is the proposed site of the Free trade zone within Ondo State and the only one

of such within the South-West Nigeria. The Olokola LNG when fully operational will contribute towards reduction of environmental disasters from gas flaring. However, the environmental implications of the activities of the organisation can also contribute to degradation and affect small and medium size firms when inappropriately manage.

FIGURE 4: SHOWING OPOLO AND PARAWE – GAS FLARING STATIONS

Source: Google Earth (2014)

Figure 4 shows Opolo and Parawe within Ilajeland. These communities are base to gas flaring station operated by Chevron.

FIGURE 5: SHOWING PARAWE, MAHIN, OLOTU AND OGIDIGBA WITHIN ILAJELAND

Source: Google Earth (2014)

Figure 5 shows Mahin community. This community is significant also as it is the home of the traditional ruler of

Mahin Kingdom within the local government. The Amapetu of Mahin (King of Mahin) command much respect among traditional rulers within the Niger Delta region of Nigeria. However, very close to Mahin is another prominent community – Ugbo. The Olugbo of Ugboland (King of Ugbo) has his seat in this community. These traditional rulers in themselves could influence how things are done within Ilajeland but it is uncertain whether they are aware of the extent of environmental damage done to Ilajeland by Chevron and other oil companies operating within the area.

FIGURE 6: SHOWING EBUTE IPARE, OGOGORO, PARAWE AND IJO ODO WITHIN ILAJELAND

Source: Google Earth (2014)

Figure 6 shows Ogogoro and other communities within the local government area. Ogogoro is significant because oil was discovered there in 1952 even before the commercial discovery of oil at Oloibiri (Presently Bayelsa State of Nigeria.

FIGURE 7: SHOWING OLOTU, AJAPA, MAHIN, OGIDIGBA AND PARAWE WITHIN ILAJELAND

Source: Google Earth (2014)

Figure 7 shows Olotu, Mahin, Ajapa and Ogidigba. Olotu is a typical example of how close every other Ilaje communities are very close to the Atlantic Ocean within the local government.

FIGURE 8: SHOWING AJAPA, OPUBA, AND TSEKELEWU WITHIN ILAJELAND

Source: Google Earth (2014)

Figure 8 reveal other flaring communities within the Ilajeland. For example, Ajapa is just few miles away from Opuba – a flaring station. This is a typical demonstration of how communities are close to each other within Ilajeland.

FIGURE 8B: SHOWING OPUBA, MOLUME, AND TSEKELEWU WITHIN ILAJELAND

Source: Google Earth (2014)

Figure 8b shows other flaring stations communities such as Molume and Tsekelewu. Again, Molume is just a

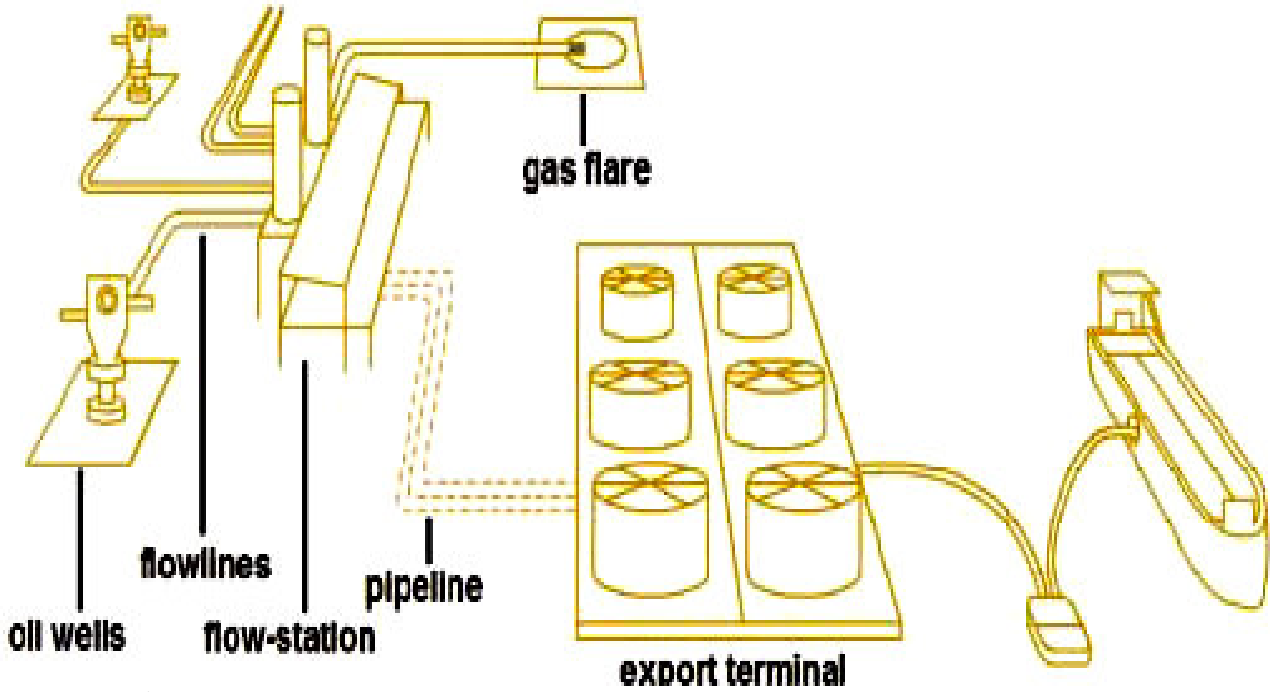
few meter to the Atlantic Ocean and fishing predominantly continues in this community like every other communities within Ilajeland.

3. GAS FLARING

Crude oil is a mixture of liquids and gases, mostly of hydrocarbon contents, and brought to the surface by drilling (Ake, 1979) cited by Nwaugo, Onyeagba & Nwachukwu (2006, p. 1824). While the removal of the associated substances (water, inorganic matters and gases) with crude oil does not change its state (Nwaugo et al., 2006), the devastating effect on the environment and stakeholders has been recognized and identified in extant research (Aigbedion & Iyayi, 2007, p. 35; Owolabi & Okwechime, 2007, p. 12). Gas flaring is mainly used to dispose of associated gases with crude oil to make it more economically useful (Bassey, 2008, p. 8). There are arguments that the exact scientific impact of gas flaring on health and safety, environment and stakeholders has not been conclusively established (Bassey, 2008, p. 5; Elvidge et al., 2009, p. 597). However, our findings suggest that there are environmental, health and safety concerns relating to gas flaring not just in Nigeria but globally especially in view of climate change.

In view of environmental security and justice, the questions are what impacts to the environment and the stakeholders may occur as a result of gas flaring in Nigeria? How harmful are these impacts to health and safety? For example, in terms of health implication, gas flaring was found to cause acid rain which acidifies the lakes and streams and damages crops and vegetation. It also lead to corrosion of roofs and it is a known carcinogen which has affected human health including causing miscarriages and congenital malformations, increasing the frequency of respiratory illnesses and cancer. How possibly would these impacts occur and what exactly could be done to manage these impacts? These research questions form the basis of analysis in this study. What exactly is gas flaring? Gas flaring is the controlled burning of natural gases associated with oil production (Nwaugo et al., 2006, p. 1824). After the initial separation of crude oil into gas, oil and water, the oil is sent to refineries for fractional distillation, the gas is often flared (burned) while the water is discharged into the environment (Wills, 2000; Zara & Paul, 2001) cited by Nwaugo et al. (2006, p. 1824). This process is as shown in figure 9; however, there is strong evidence to argue that this is like flaring and slaying possibly causing real trouble in the air and on stakeholders (Steiner, 2010, p. 13; Nwaugo et al., 2006, p. 1824; Bassey, 2008, p. 2).

FIGURE 9: DEMONSTRATING THE PROCESS OF OIL PRODUCTION



Source: Steiner (2010)

4. ISSUES FOR AWARENESS: GAS FLARING IN NIGER DELTA REGION OF NIGERIA

The environmental disasters and problems in the Niger Delta region of Nigeria has been documented in several studies (e.g. Mafimisebi, 2013; Nkwunonwo & Mafimisebi, 2013; Mafimisebi & Nkwunonwo, 2014; 2015;

Mafimisebi & Thorne, 2015; 2016). However, of particular concern, evidence to wasteful oil and gas operations, gas flares are a distinctive feature of the Niger Delta landscape. Most of these flares are burn 24 hours a day and some have been doing so for over 50 years in the Niger Delta region of Nigeria. The communities within these flare areas are usually deprived of even the comfort of night's natural darkness. Though it has not been conclusively assessed, the impact of gas flares on the local ecology and climate change as well as people's health and property is evident. The extremely high levels of Carbone dioxide and methane gases that are released to the atmosphere also impact climate patterns beyond the local level (Steiner, 2010). It has been revealed that gas flaring usually lead to ozone layer depletion, climate change, global warming, acid rain and rise sea level. Acid rain, for example, a direct result of gas flaring is taking its toll on the Niger Delta region of Nigeria. The main issues for awareness include:

a. GLOBAL WARMING:

The greenhouse effect refers to the phenomenon whereby carbon dioxide and other gases trap long-wave infra-red radiation (heat) in the atmosphere thereby warming the earth (Nkwunonwo & Mafimisebi, 2013). It is an entirely natural phenomenon: without the effect, the average temperature on earth would be 33 degrees C lower than at present. The infra-red radiation emitted by the earth can be tapped by atmospheric carbon dioxide (CO_2), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), methane (CH_4), ozone (O_3), and other gases. The concentration of these greenhouse gases (GHGs) in the atmosphere reduces the re-radiation of heat into space. The operation of this mechanism has become a pollution problem because of the rate at which anthropogenic emissions of infra-red trapping gases have increased, creating a larger stock in the atmosphere.

However, major sources of CO_2 are the combustion of fossil fuels, such as oil, coal and gas; CO_2 is also produced naturally by decay. Major natural sinks for CO_2 exist, where the gas is locked up. These include the world's oceans and peat bogs. The concentration of CO_2 in the upper atmosphere has risen from roughly 280 parts per million (ppm) in 1880 to 355 ppm today (IPCC, 1992).

The principal cause of this increase has been the combustion of fossil fuels. Major sources of N_2O are the combustion of fossil fuels and the production of fertilisers. CFCs are produced as propellants, refrigerants and foam expanders, and are used in air conditioning systems. Methane is produced from sewage treatment, livestock wastes and landfill sites. The four major greenhouse gases vary in terms of their lifetimes in the atmosphere before they are broken down (CO_2: 50 years; N_2O: 150 years; CFCs: 75-110 years; and methane: 9-13 years; and methane: 9-13 years (IPCC, 1992). They also vary in terms of the 'radiative forcing' that each induces and in their current contribution to the level of warming potential. In terms of the physical results of the greenhouse effect, these are subject to wide range of predictions. Current mainstream predictions show a rise in global climate of between 1.5 to 4.5 degrees C by the next century for a doubling of CO_2 (Jamieson, 1988); and a rise in sea level of between 0.6 – 3.5m by 2100 (Titus, 1989).

b. THE STRATOSPHERIC OZONE LAYER

High above the earth's surface a relatively thin layer of the gas ozone (O_3) performs a vital function. If the earth's atmosphere were compressed to a pressure of 1000 millibar the atmosphere would be 5 miles thick. Of this, the ozone layer would only account for some 3mm. This is how ozone levels are now measured: in Dobson units (Nisbet, 1991). Ozone is formed naturally in the upper atmosphere when oxygen molecules are struck by ultra-voilet light from the sun. Ozone absorbs ultra-violet (UV) light, and is continually being broken (into oxygen) and recreated in natural equilibrium. Ozone also acts as a greenhouse gas. The chlorofluorocarbons can break down ozone. The process is a complicated one. CFCs contain chlorine atoms. These can attach themselves to oxygen atoms in ozone, forming oxygen and chlorine monoxide, the presence of the latter being one test for ozone thinning. One chlorine atom can break down 100,000 molecules of ozone in this way. As the concentration of ozone falls, so does the temperature of the stratosphere. This leads to the formation of ice clouds which greatly speed up the ozone degradation process, by providing a surface for reactions to take place which allow chlorine atoms to be separated from their constituent molecules, and thus become available for ozone destruction. In this sense, the ozone hole feeds on itself (Nisbet, 1991).

What are the costs of stratospheric ozone thinning? Most studies have looked at increased incidence of skin cancers (including potentially fatal melanomas), suppression of immune systems and increases in eye cataracts (Mintzis, 2009). UNEP have estimated that a 10 per cent drop in ozone levels can produce a 26 per cent rise in non-melanoma skin cancers (Australia has already recorded a three-fold rise in incidence of this disease). Dickie, Gerking and Agee (1991) report a study estimating WTP for the reduction of risks of skin cancer due to increased UV radiation. Critically, high doses of UV rays can also damage crops especially soybeans. Potentially the greatest long-term impacts however involve damage to krill stocks which play a vital role in marine food chains. Some studies (for example, Nordhaus, 1991) have also studied the cost of reducing CFC emissions. The main problem here is that cutting new production of CFCs will not be sufficient to cut emissions in the short time, since CFCs are stored in air conditioning units, refrigerators and blown foam. If households face too low an

incentive to recycle these CFCs, then releases will occur. Remarkably, most cost estimates for long-term CFC control rest on substitutions to more costly alternatives but many of these alternatives involve environmental costs too: freons, for example, also deplete ozone (Nordhaus, 1991).

c. CLIMATE CHANGE

Gas flaring releases greenhouse gases including carbon dioxide and methane into the atmosphere. Of these two, methane is actually more harmful than carbon dioxide (Steiner, 2010; Mafimisebi & Nkwunonwo, 2014). It is also more prevalent in flares that burn at lower efficiency. Those less efficient flares tend to have more moisture and particles in them that reflect heat and are said to have similar effect on the ozone layer like aerosols do (ERA, 2005). These are more harmful than more flares that burn more efficiently. In such flares the produced methane gets converted into carbon dioxide. On a casual observation of the flares in the Niger Delta one sees that they are sooty and are evidently burn at low efficiency (Figure 9).

Generally, climate change impacts are more pronounced on low-lying coastal areas such as the Niger Delta. These areas are prone to freak weather events, flooding, and coastal erosion and are the first to be affected by sea level rise (Bassey, 2008). Due to raised temperatures, climate change favours proliferation of pests and spread of diseases. As mentioned earlier, they also seriously affect agricultural productivity. Having these climate change aiding gas flares located in the Niger Delta, one of the most vulnerable parts of Nigeria, is indeed a double tragedy (Mafimisebi & Nkwunonwo, 2014; 2015). Actions must be taken for the protection of the environment, tackling climate change and for the survival of the people. These actions must include strategies such as climate change education, elimination of gas flaring, regular training of policymakers in disaster risk reduction and management, and involvement of local communities in risk reduction programs.

5. THE EXPLORATION AND PRODUCTION OF NATURAL GAS IN NIGERIA

The exploration and production of natural gas in Nigeria is accidental to the exploitation of crude oil. Undoubtedly, so far, no deliberate effort has been made to explore for gas in Nigeria. Nigeria has a considerable reserve of natural gas. The present largest production sites of oil are also the production sites of gas, the latter is often found with petroleum (associated gas). Gas production started in 1957 with an output of 2,014 million cubic feet and for now, it has increased to about 2 billion standard cubic feet; but about 60 per cent of the over 2 billion standard cubic feet is flared. It is to be noted that 12 per cent of gas produced in Nigeria is re-injected to enhance oil recovery (Dike, 1991).

Nigeria has an estimated 157 Trillion cubic feet of proven natural gas reserve, 9th largest in the world. With this enormous quantity of gas, Nigeria is generally acknowledged as a gas province with little oil on it (Okoroji, 1996; Gaius-Obaseki, 1996; Eghre and Omole, 1999) cited by Aghalino (2009). It would appear that because of the high gas-oil ratio in Nigeria's formation, gas fields were not developed.

EXPERIMENTAL SECTION

This research adopted the experimental procedures of Elvidge, Ziskin, Baugh, Tuttle, Ghosh, Pack, Erwin & Zhizhin (2009) to reveal the patterns in which gas flaring has evolved over the years in Nigeria. Colour composite of the night time lights of the Nigeria region generated using 1994 as blue, 2000 as green, and 2008 as red. The colours of the flares indicate their activity patterns during the three years used in the colour composite. Note the six red offshore flares, indicating the increase in offshore oil production in 2008 relative to 2000 and 1994. The vector polygon drawn around the gas flares of Nigeria is shown in yellow. The diffuse light in the upper right is from biomass burning. This experiment is shown in the figure 9 below. This experiment is also consistent with satellite detection of gas flares across the world for the year 2013 (Figure 9b) obtain from VIIRS Satellite (World Bank Group, 2015).

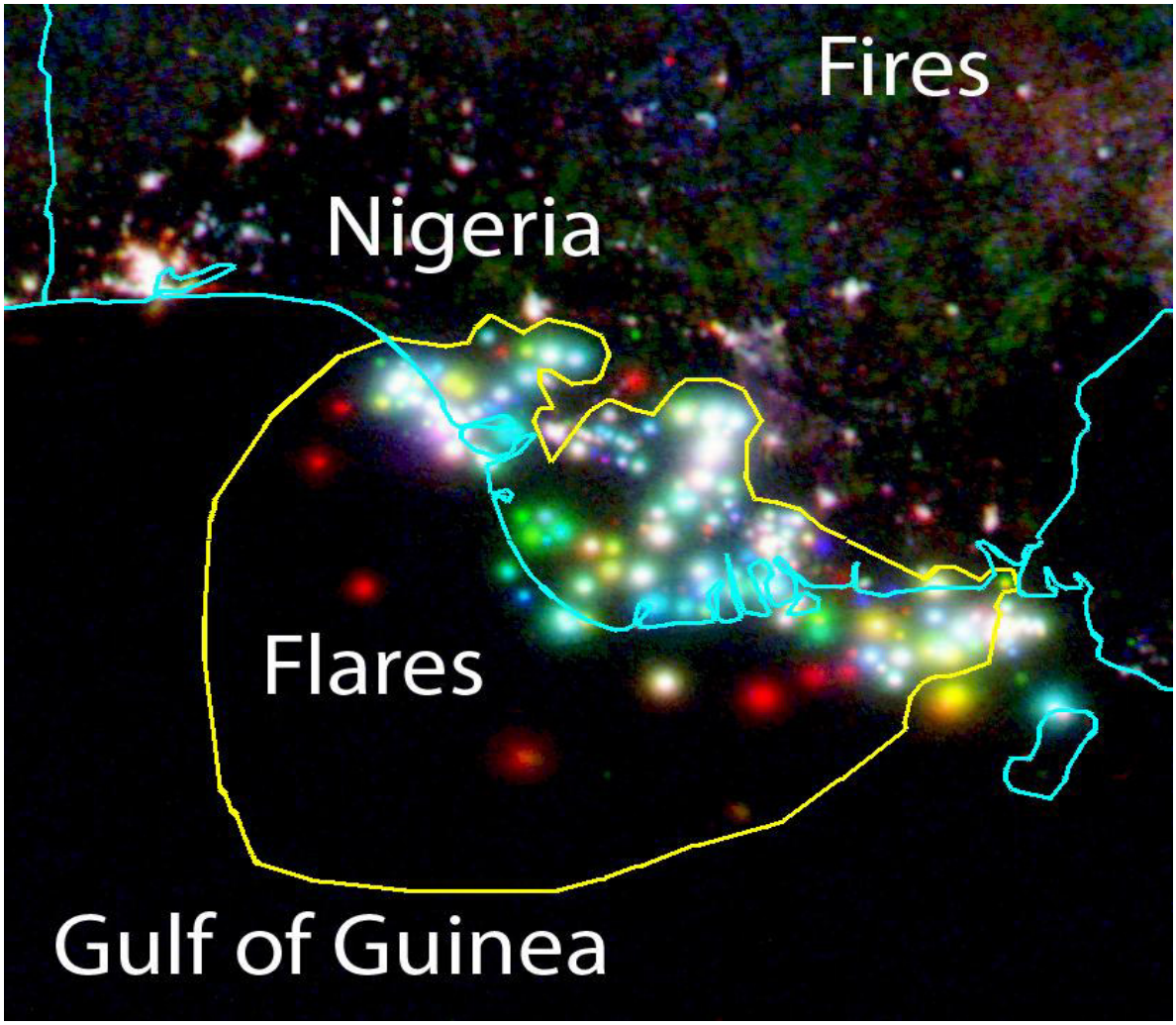


Figure 9: Source: Elvidge et l. (2009)

Figure 9b: Satellite Detection of Gas Flares – Compilation for 2013 (VIIRS Satellite)

VECTORS AND EXTRACTIONS: Using these three visual criteria and the Google Earth inspection it is possible to manually draw vector polygons to identify the gas flares for Nigeria. The figure A above shows an example of the vectors drawn for the country of Nigeria. An extraction was then run on the sum of lights and cloud-free coverage Mollweide projection images. The extracted fields include the area of lighting detected, the number of saturated grid cells, the minimum, maximum and average number of cloud-free observations encountered under the polygon vectors, and the sum of lights index. The extraction produces a text file (csv) that can be imported into a spread sheet for analysis and plotting (Elvidge et al., 2009). Again, identification of three flames at a gas flaring location using high resolution base imagery available in Google Earth is shown below (Figure 10). Each of the DMSP identified gas flare locations were inspected in Google Earth for visual confirmation of the feature and to eliminate the inclusion of human settlements and features such as airports from the final set of gas flare features. A total of 2,500 gas flaring features were identified using Google Earth as shown in Figure 10 below (cf. Elvidge et al., 2009).

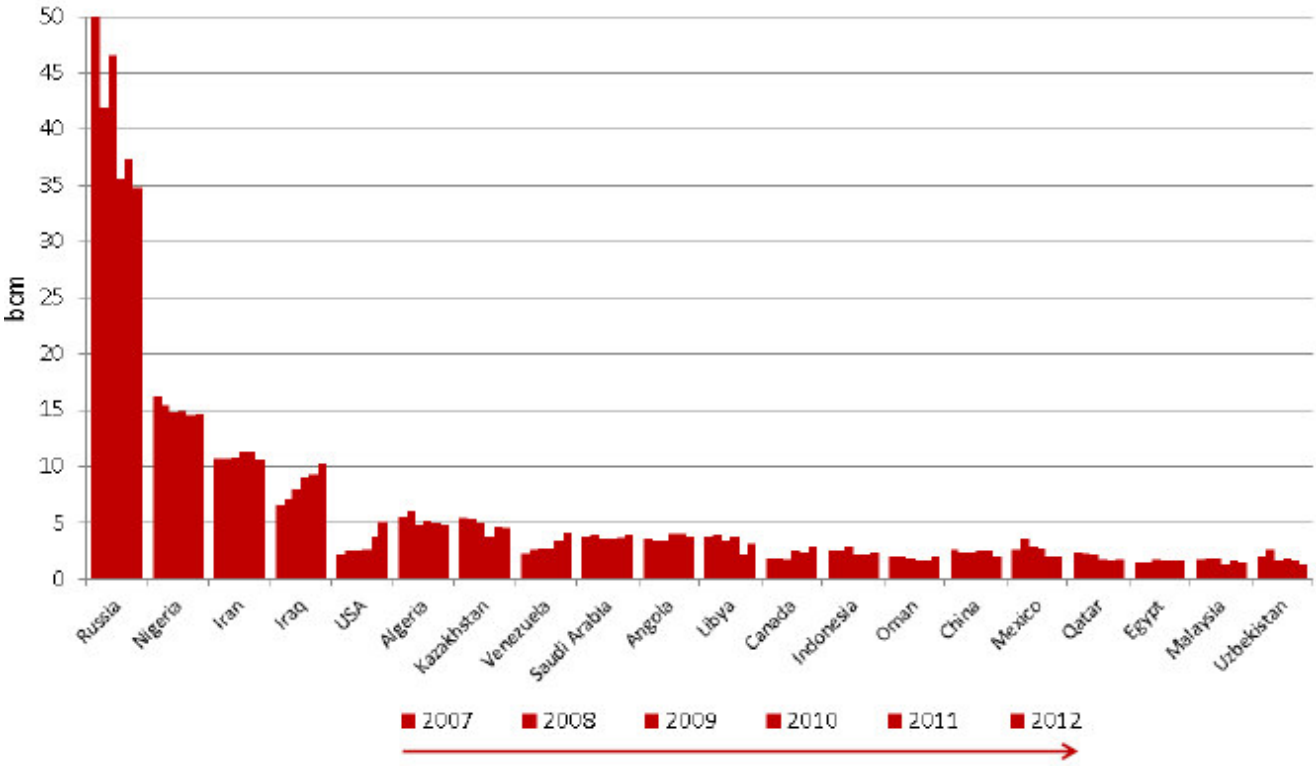
Figure 10: Gas Flaring Features Identified from different Location in Nigeria

6. GLOBAL IMPACTS FROM GAS FLARING AND NIGERIA POSITION

Nigeria is the second largest offending country, after Russia, in terms of the total volume of gas flared. In 2004 Nigeria's volume of gas flared was equivalent to one-sixth of total gas flared in world. Globally, the volume of gas flared between 1996-2006 (during which time awareness of the detrimental impact of flare emissions on the global climate grew) remained relatively constant, ranging between 150-170 billion cubic meters (BCM). Nigeria's share of the total volume is approximately 24.1 BCM of gas (By comparison, the U.S flared 2.8 BCM during the same time period). Gas flaring causes acid rain, which impacts soil fertility and is associated with reduced crop yields, causing hunger in the Niger Delta where fish populations already have declined due to pollution by oil companies. Acid rain eats through villagers' roofs that protect local residents from rain. Impoverished villagers have little means to replace their roofs more frequently.

From research, 168 billion cubic meters of natural gas is flared yearly worldwide which is enough to produce more than 750 billion kWh power. It is equivalent to 25% of gas consumption in the USA and 30% of EU gas consumption and more than the entire power consumption on the African continent. The flares pump 400 million tons of CO2 annually into the atmosphere and about 15% of the gas flared in the world comes from Nigeria alone and stands at about 23 billion cubic meters per year (Figure 11 and A). This quantity is enough to meet Nigeria's energy needs and leave a healthy balance for export. There are over 100 flare sites still emitting a toxic cocktail of chemicals into the atmosphere in the Niger Delta. Through this obnoxious act the country has lost about $72 billion in revenues for the period 1970-2006 or about $2.5 billion annually (Bassey, 2008). All these go up in smoke yearly, leaving death and destruction in its path.

FIGURE A: YEAR 2007-2012 GAS FLARING ESTIMATES IN BILLIONS OF CUBIC METERS (BCM) FOR THE TOP 20 COUNTRIES.



6.1 GAS FLARING EFFICIENCY

Gas flaring efficiency of the top eight flaring countries in the world is as represented in the figure 12 below. However, Nigeria is ranked second in the world behind Russia in terms of gas flaring. Efficiency is defined as the volume of gas flared per barrel of crude oil produced. Nigeria is least efficient, but seems to be improving with time. Saudi Arabia consistently out performs the other top flaring countries implying that it is quite efficient in the utilization of associated gas (Figure 12). The main lessons for Nigeria include (1) the need to utilise the gas flare for economic use; (2) end routine gas flaring and stop issuing permit to oil companies to allow them flare gas; (3) raise fine for gas flaring; (4) raise the standard of oil and gas industry practice in Nigeria.

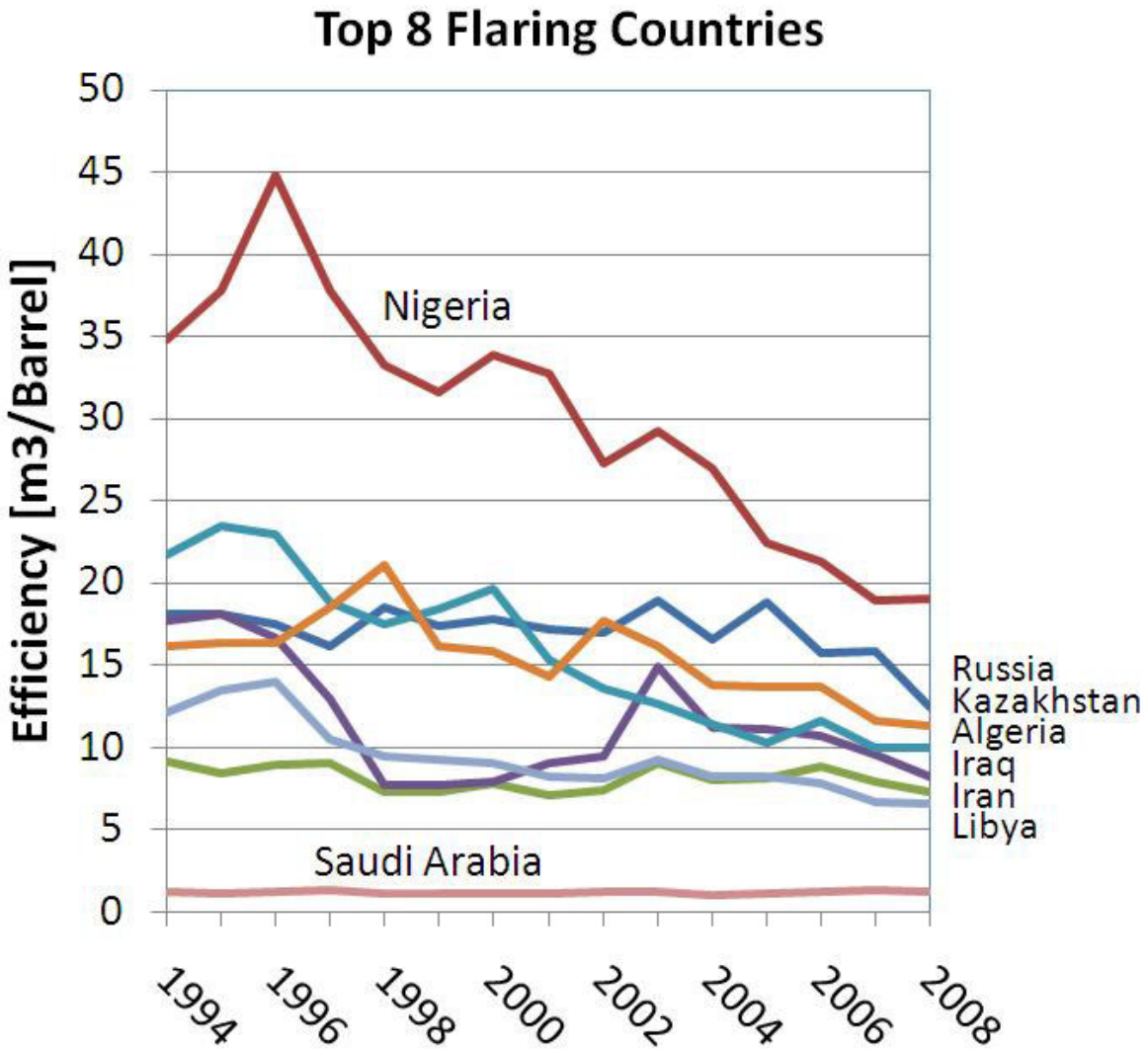


Figure 12: Source: Elvidge et al. (2009)

However, there are several factors which may affect the efficiency results in addition to changes in gas utilization practices. If more gas is vented (without flaring) or re-injected into the ground the satellite data would likely find that there had been an increase in flaring efficiency (Elvidge et al., 2009). There is variation in the gas content of crude oil from different fields and gas-to-oil ratios can change gradually over time. Changes in the gas-to-oil ratio are sufficiently gradual that this could only be a minor component in the trend observed from 2005 to 2008, where global gas flaring declined by 19%. A change in the diurnal or seasonal pattern of flaring could also affect the efficiency calculation since the DMSP sensor only detects flaring in the early evening and data from mid-to-high latitudes are not usable in mid-summer due to solar contamination of the night time visible band data. Certainly, under or over reported oil production would have a direct effect on the calculated efficiency, as well as errors in our identification of flares. Among the countries which improve their flaring efficiency we are not able to determine whether this indicates a change in the gas content of the oil, improved capture and utilization of the associated gas, an increase in reinjection, or more venting of unburned gas (Elvidge et al., 2009).

6.2 FLARING GAS IS ILLEGAL IN NIGERIA

The first order by a Nigerian Head of State related to flaring was in 1969 when President Yakubu Gowon ordered that within 5 years of set-up, a company must cease flaring of gas. This order was ignored by almost all oil and gas companies in Nigeria; and the government has never make drastic measure to enforce the relevant Nigerian laws prohibiting gas flaring. Through the Associated Gas Re-Injection Act No. 99 of 1979, the Nigerian government required oil corporations operating in Nigeria to guarantee zero flares by January 1, 1984. Oil companies nonetheless have continued to flare gas, merely paying nominal fines for breaking this law. The Act

allowed some conditions for specific exemptions or the payment of a fee of US $0.003 (0.3 cents) per million cubic feet, which increased in 1988 to US $0.07 per million cubic feet, and in January 2008 to US $3.50 for every 1000 standard cubic feet of gas flared. However, this is still considered cheap and not a deterrent for companies, which find it easier to just pay the fine (Steiner, 2010). Subsequent federal Nigerian legislation repeatedly pushed back the deadline to end gas flaring absolutely—in other words, such that it would require companies to cease flaring and discontinue the policy of allowing them to pay a fine for continuing to flare—most recently to year-end 2007, then 2008, then 2010. As of January 2010, the Nigerian National Assembly was proposing a new deadline of 2012. In 2005 the Federal High Court of Nigeria ruled that gas flaring by Shell and its major partner (NNPC, with which oil in Nigeria companies jointly operate) is illegal and a violation of the rights to life and dignity (ERA, 2005). Nevertheless, several reasons have been identified for why oil and gas companies continue to flare gas in Nigeria. For example, some of the reasons include (1) infrastructure and markets that are under-developed and poorly functioning discourage investments in flare elimination; (2) unconducive policy environment – legal, regulatory, investment, and operating environment; (3) distance from energy users, gas pipelines and power networks which could make investments in gas utilization less attractive; and (4) gas characteristics for the flared gas could be less economical or favorable.

7. CHEVRON ENVIRONMENTAL POLICY

The Chevron Environmental Standards (Chevron, 2005) states that the company maintains an operation that offers health, security and environmental protection as follows:

> *We place the highest priority on the health and safety of our workforce and protection of our assets and the environment. . . We operate under the same high standards in relation to the environment and security in all the countries where we do business (Chevron, 2005) cited by Oilwatch (2006, p. 7).*

The above environmental policy statement has been criticized in view of environmental complaints in Nigeria (Oilwatch, 2006, p. 7). How likely is Chevron maintaining environmental standards in Nigeria? There is evidence to suggest that Chevron is committed to end gas flaring in Nigeria. For example, Chevron is involved in natural gas projects in the Western Niger Delta and Escravos areas (Chevron, 2012, p. 2). The project is focused on eliminating routine flaring of natural gas associated with the production of crude oil. The $2.4 billion project is expected to be completed in 2016 (Chevron, 2012). This implies that Chevron may continue to flare gases till 2016 and beyond. However, it is uncertain if Chevron could prove the exact environmental damage done to Ilajeland as a result of its gas flaring activities. It may also be difficult to identify the exact measures applied in this regard.

8. ANALYSIS

It is assume that gas flaring has no significant impacts on the environment and stakeholders. But more broadly, there is evidence to suggest that this argument is incorrect (Steiner, 2010; Stern, 2009; Bassey, 2008; Nwaugo et al., 2006). If this is correct, what environmental strategies could be applied to manage the impacts? It could be obviously irresponsible to act on the hypothesis that the evidence is incorrect even though the severity is low (Ikporukpo, 2004, p. 327). Again, if the evidence is right; the question is who might be harm and how can this be manage? It is therefore expedient to identify the stakeholders who might be impacted by gas flaring.

8.1 FALSE SOLUTIONS AND THE LURE OF LIQUEFIED NATURAL GAS (LNG)

It is interesting to note that whenever attempts are made to explain what is being done to halt gas flaring in Nigeria reference is made to the huge investments being made in the LNG sector. Investment aimed at developing the LNGs means a lack of investment in renewable energy (Bassey, 2008). The LNGs tie the economy to big business and renders Nigerians once again as mere consumers where we ought to be producers. The entire argument reaches a nauseating level when steps taken to reduce gas flaring are now seen as steps that ought to be rewarded through mechanisms in the fossil capitalist schema. This is why an oil corporation would want to claim carbon credits for setting up a gas plant that itself has a huge carbon foot print and is equally contributing to the stock of greenhouse gases in the atmosphere. It could even be said that corporations who have been in default with regard to the obnoxious acts of gas flaring, instead of being punished for the infractions are being placed on the podium to be garlanded and awarded prizes for merely slowing down on the offending path. The question then is: is investment in LNGs fair enough to the detriment of the health and safety implications of gas flaring?

8.2 STAKEHOLDERS

The stakeholders that may be impacted as a result of Chevron gas flaring activities within Ilajeland include but not limited to the following:

- Ilaje Residents
- Fishermen

- Farmers
- Ilaje Local Government Council
- Ondo State Oil Producing Development Commission
- Ondo State Government
- Small Business Operators/Owners
- Ilaje Traditional Rulers
- Consumers of fish and farm products
- Chevron shareholders
- Chevron employees working within Ilajeland
- Visitors to Ilajeland
- The public

Although the World Bank has rated gas flaring as needing lower attention in the Niger Delta region (Agbola & Olurin, 2003), in view of global best practice in environmental issues; high priority attention is arguably needed. While it may not be possible to halt gas flaring immediately, it is possible to slow down and control gas flaring, with aid of research, find ways of managing its harmful effects. Critically, deliberate environmental management of gas flaring is needed if Chevron is to be perceived 'green' within Nigeria. This could pose challenges to Chevron with huge implications for stakeholders.

For example, research and increased awareness of the 'concept of flaring and slaying' could impress on Chevron the need to look at the green implications of their operations especially the level of emissions. How can this be? One consideration is that the "polluter-pays" principle is acknowledged, although, the seemingly weaknesses of Nigeria environmental law (FEPA & NESREA Act) could hinder liability and compensation (Ekpu, 1996, p. 96). It might be that as public consciousness of the 'concept of flaring and slaying' increasing grow with gas flaring having adverse effects on stakeholders within the area, Chevron would have to provide information on how gas flaring will affect them and environmental assurance that it incorporated into its environmental risk management. Likewise, the company could continue to pay fines under the Associated Gas Reinjection Act 1979 and Gas Flaring (Prohibition and Punishment) Act 2009 except it ends gas flaring. It is unlikely that this fine is commensurate to the harm done and the cost of alternatives. One question that continues to trail this research is what impacts could gas flaring caused to the environment, health and safety of the earlier identified stakeholders?

8.3 ENVIRONMENTAL IMPACTS OF GAS FLARING

This section would discuss the environmental impacts of gas flaring as well as the health and safety implications on the stakeholders. In this context, appropriate legislations shall be considered. There is massive evidence to argue that gas flaring has huge adverse effects on the stakeholders within Ilajeland. For example, literature shows that gases emitted into the atmosphere during such flares are hazardous as they contain carbon dioxide (CO_2), nitrogen oxides (NO_x), sulphur dioxide (SO_2), dioxin, xylene, styrene, naphthalene, benzene, hydrogen sulfide and toluene and other carcinogenic volatile organic compounds (TRIP Report, 1999, p. 5; Bassey, 2008, p. 9; Oruamabo, 2005, p. 17; Environmental Rights Action (ERA), 2005, 2012).

Gas flaring make the environment and people living within the flaring zone to be vulnerable to different risks. But, how correct is this argument? In terms of health and safety, scientific studies have linked breathing particulate matter to a series of significant health problems including; aggravated asthma, increase in respiratory symptoms like coughing and difficult breathing, chronic bronchitis, decreased lung function, and premature death (Ologunorisa, 2001, p. 252; ERA, 2005, p. 14). Again, it has been clearly established and accepted that exposure to benzene and its metabolites cause acute nonlymphoctic leukaemia and a variety of other blood-related disorders in humans (US EPA, 1997). To simplify these findings, flaring could be the likely cause of pneumonia, premature deaths and cases of leukaemia (ERA, 2005; Oruamabo, 2005, p. 14; Bassey, 2008, p. 9) in Ilajeland. Table 2 shows the potential health implications from some of the stated hydrocarbon compounds. A substantial number of persons could be exposed to these emissions within the area.

TABLE 2: THE POTENTIAL HEALTH IMPLICATIONS OF SOME SELECTED HYDROCARBON COMPOUNDS

Compound	Health Effects
Benzene	Blood disorder including reduced number of red blood cells and aplastic anemia, pancytopenia, leukaemia
Naphthalene	Destroying the membrane of the red blood cells with the liberation of haemoglobin, cataracts, headache, confusion, excitement, malaise, profuse sweating, nausea vomiting, abdominal pain, irritation of bladder.
Styrene	Irritant of the skin, eyes, and mucous membranes, and central nervous system effects.
Toluene	Central nervous system effects which leads to narcosis, incoordination, emotional liability, headache, and fatigue.
Xylene	Central nervous system effects which leads to delayed development, decreased fatal body weight, and altered enzyme activities

Source: US EPA (2003, 2007)

Carbon dioxide emissions in the Niger Delta region of Nigeria are among the highest in the world (Iyayi, 2004). The extremely high levels of CO_2 and methane gases released into the atmosphere during flaring also impact climate patterns beyond the local level (TRIP Report, 1999, p. 5) and have similar effect on the ozone layer (Bassey, 2008, p. 10). In view of TRIP Report (1999, p. 5) acid rain, a direct result of gas flaring, is taking its toll on the Niger Delta (including Ilajeland). Acid rain impacts the stakeholders' livelihood in two ways, loss of biodiversity through destruction of vegetation and corrosion of metallic surfaces such as zinc-plated roofing sheets (Uyigue & Ogbeibu, 2007).

There seems to be causation between gas flaring, ozone layer depletion, global warming and acid rain in view of exiting research (Bassey, 2008, p. 10; Okon & Akunna, 2010, p. 7; Oruamabo, 2005, p. 17). Thus, the consideration of issues and problems for awareness as a result of gas flaring is presented in Table 3. It is revealed that due to low efficiency of many of the gas flares much of the gas is released as methane (CH_4) rather than CO_2 (Eweje, 2006, p. 39). However, according to ERA (2005, p. 15) methane has a much higher global warming potential than CO_2 even though it is shorter lived; after 20 years, 1kg of methane is 62 times more powerful than 1kg of carbon dioxide. What implication could this has on the environment and stakeholders? A model for the consequence assessment of environmental risks chain of gas flaring is represented in Figure 13.

TABLE 3: ISSUES AND PROBLEMS FOR AWARENESS AS A RESULT OF GAS FLARING

Environmental Aspect	Issues and Problems for Awareness	Impact
Gas Flaring	Ozone layer depletion	Rising sea level
	Climate change	Heat
	Global warming	Noise
	Acid rain	Flooding
	CO_2 Emissions	Lose of vegetation
	Carbon monoxide	Adverse effect on fishing and farming
	Air pollution	Contaminated seafood
	Environmental degradation	Poverty and bitterness
		Erosion
		Sea incursion
		High mortality
		Loss of portable industrial water
		Vibrating coming out from the flow stations
		Rural underdevelopment
		Destruction of mangrove swamp and salt marsh
		Suppressing the growth and flowing of some plants.
		Killing of vegetation around the flare area.

It may be uncertain to ascertain the exact volume of gas flared within Ilajeland by Chevron alone since

1968. Arguably, the environmental impacts of such associated gas could be hazardous to human health. For example, Kindzierski (2000) revealed the effects of gas flaring on human health to include cancer and non-cancer, neurological, reproductive, and development effects. Critically, it is possible that gas flaring over the years has caused noise and air pollution, steady temperature rise, acid rain, corrosion of roofs and respiratory diseases (Social Action, 2009, p. 14) within the area. Empirical studies show that gas flaring causes disturbed sleep rhythm because of the bright light and heat from the flares (Oruamabo, 2005, p. 17). A typical picture of continuous gas flaring within Ilajeland since 1968 is as shown in figure 14. In view of Nwafor et al. (1991) cited by Oruamabo (2005, p. 17), gas flaring has been shown to result in low white and red blood cells counts in host communities with the possibilities of impaired resistance to infection. Issue for consideration might be which stakeholders are more vulnerable and impacted?

The health impacts of gas flaring could spreads across stakeholders, and those consumers of fish and farm products who rely on fish from Ilajeland might even risk higher contamination. Unsurprisingly, the degree of vulnerability could vary and may depend on the proximity to the flaring stations within the area. Proximity has been defined as any distance between 0.2km to 35km from the gas flare (Argo, 2002) cited by Ovuakporaye (2012, p. 16). Okonkwo (1983) cited by Ologunorisa (2009, p. 252) found that liver damage and skin problems were common effects associated with flare pollution in Nigeria. How correct is this finding? Recall, it may be extremely dangerous to ignore the thesis that the science and evidence is wrong as earlier stated. The Health and Safety at Work Etc. Act 1974 in Nigeria place a 'duty of care' on Chevron for the health and safety of its employees working within gas flaring stations.

Within the context of environmental legislations in Nigeria, Section 2.1 of Environmental Impact Assessment (EIA) Act 1992 requires an Environmental Evaluation (EE) for already polluted or impacted environment. It is not clear whether Chevron has complied with this requirement as its gas flaring activity is arguably polluting and impacting on the environment within Ilajeland. Thus, Chevron is mandated by law to carry out an EE Report for its gas flaring activities within Ilajeland. It is suspected that Chevron has not fully complied with this requirement. If so, the report has not been made available to the public. What risk assessment method could then be used to identify and evaluate whether the effects of gas flaring is significant and detrimental to the environment, health and safety?

FIGURE 13: A MODEL FOR THE CONSEQUENCE ASSESSMENT OF ENVIRONMENTAL RISKS CHAIN OF GAS FLARING

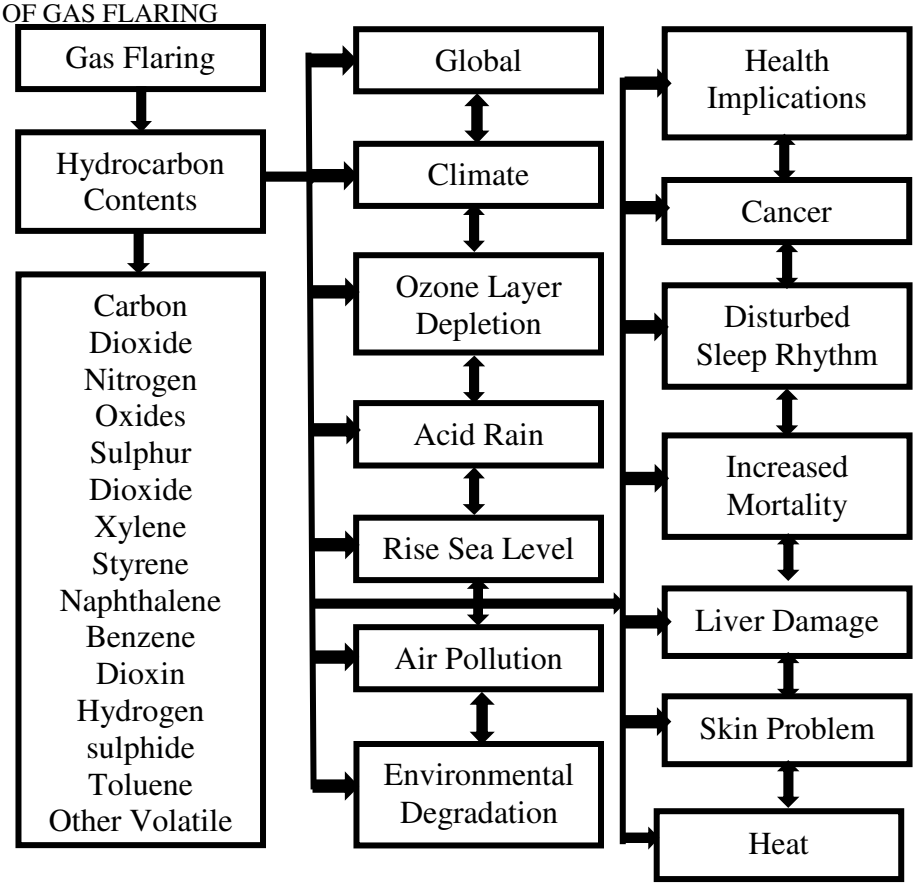


FIGURE 14: PICTURE OF CONTINUOUS GAS FLARING WITHIN THE NIGER DELTA

Gas flare in Niger Delta, 2006
Source: Steiner (2010, p. 14)

9. ENVIRONMENTAL RISK ASSESSMENT METHOD

One risk assessment method that seems appropriate for this research is Cost – Benefit Analysis because it could reveal a business case for investing in gas flaring elimination project. Therefore, one option before Chevron is perhaps to analysis the costs and benefits of the impacts of gas flaring on the environment. In this context, the full range of the potential consequence, magnitude, significance, priority, cost, legislation and stakeholders' perception possibly requires consideration (see Table 4).

TABLE 4: COST – BENEFITS ANALYSIS OF GAS FLARING ELIMINATION INVESTMENT

Cost	Benefit	Impact	Magnitude	Significance	Legislation	Stakeholders' Perception
Research revealed that the associated cost of gas flaring elimination investment is hugely high (Chevron, 2012).	The long term benefits especially reduction in fines or no fines at all and the accrued revenue from the proceeds of the utilised associated gas is argued to beneficial for Chevron	The impact of gas flaring has been recognised and revealed in empirical studies (see table 3)	The severity of damage may not be visible immediately. As such it may be low or under-estimated.	Though the severity of impact may be low but the cumulative effects on stakeholders is argued to be significant to the environment and local people	In view of legislations such as the Gas Flaring (Prohibition and Punishment) Act 2009, Chevron need to end gas flaring with significant investment in gas flaring elimination projects.	The risk perception of the stakeholders is important in the evaluation of risk assessment. If the stakeholders perceived the risk to be high then something has to be done about it.

At a fine of $3.5 US Dollars per 1000 scf under the Gas Flaring (Prohibition and Punishment) Act 2009; it seems that like other oil companies operating in Nigeria, Chevron could continue to flare gas within Ilajeland as this possibly match economic interest. For example, an oil company was quoted stating that it was cheaper for it to flare gas at a cost of 1 million US Dollars as against the 56 million US Dollars cost of switching from water to gas injection (CDM, 2012). Therefore, it is likely that the business case for gas flaring in Nigeria is due to the conditions that favour investments rather than regulations (TRIP Report, 1999, p. 5). If so, what implications could emerge on Chevron? One argument is that the cumulative financial value of fines over the years could probably exceed the real cost of investment in gas flaring elimination. In terms of risk perception, there could be endless agitation and frustration from Ilaje communities. Thus, Chevron could risk the perception of 'environmentally irresponsible' company within Ilajeland. Applying risk sensitivity analysis, it is expedient that Chevron therefore consider the stakeholders' perception of the harmful effects of gas flaring in determining it management strategy.

Despite lack of seemingly exact scientific impacts of gas flaring (Bassey, 2008, p. 5), its likelihood and probability of occurrence is arguably high as we have reveal in this research. Though, its severity and vulnerability could depend on the proximity to the gas flaring stations yet it argued to be highly significant to the environment and stakeholders. Again, in view of international best practice especially the ISO 14001 on environment; the best available technology (BAT) is arguably needed. Even though there is no compulsion to use BAT, Chevron could still use the best available technique not entailing excessive cost (BATNEEC). Moreover, complying with international best practice such as ISO 14001 could reduce stakeholders' expectation and further positioning Chevron as a 'green' company.

9.1 ENVIRONMENTAL RISK MANAGEMENT STRATEGIES

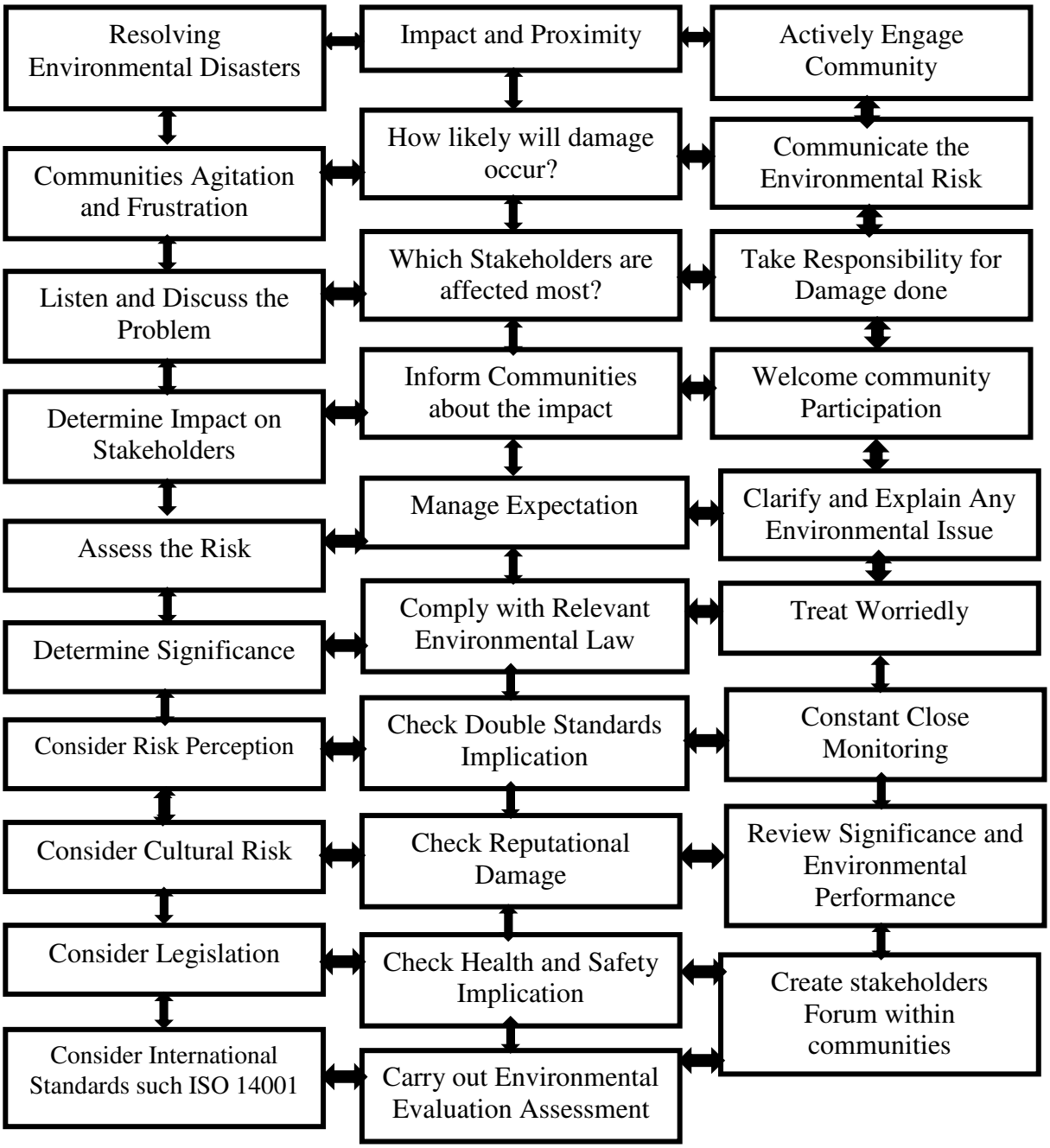
All the identified impacts arguably threaten human heath, growth and development within Ilajeland. One possible strategy that could be adopted is perhaps adaptation to the environment. The extent of that adaptation against the impacts and the supposedly malignant effect on health and safety is disputably problematic. Community-based adaptation (Mitchell & Tanner, 2006) could become necessary concept in gas flaring debate. Possibly, Chevron would have to drive environmental knowledge and resilience to gas flaring within the area. Again, the degree of adaptation could depend on the level of socio-economic and technological development (Uyigue & Ogbeibu, 2007). Most likely, vast majority of the people would thus change their means of livelihood such as fishing and farming because of the degradation of the environment as a result of gas flaring.

Frankly, there is huge escalating cost of investment associated with ending gas flaring in Ilajeland and the entire Niger Delta region of Nigeria. However, Chevron needs to justify its continuous gas flaring in Ilaje and need to be more transparent in its environmental standards policy within the area (Table 5). Noticeably, the company perhaps does this through its new Global Memorandum of Understanding (GMoU) with Ilaje Regional Development Committee and Ondo State Government (Ogbodu, 2012). What is not clear therefore is the extent of awareness on environmental security within the area. Interestingly, associated gases do not have to be flared off as it could be utilised (Bassey, 2008, p. 4). In view of TRIP Report (1999, p. 5) other strategies for managing natural gas include reinjection into the subsoil, storage for use as a source of energy by local communities, and transportation for use in other projects. Applying the building-trust with communities approach (Figure 15), Chevron could demonstrate commitment to end gas flaring within Ilajeland to the stakeholders. This approach arguably involves early consultation with stakeholders to understand their interests, concerns and priorities to ensure wider incorporation of stakeholders' perception into environmental risk management (ERA, 2007). Impliedly, for Chevron, it is likely that this could lead to reduction in complaints and marginalization issue thereby promoting positive relationship with the Ilaje people.

TABLE 5: AIR POLLUTION FRAMING ISSUES WITHIN ILAJELAND

Framing Issues	Exposure	Vulnerability	Responsibility
Evidence	The residents are the most exposed to high level of air pollution caused by gas flaring	The residents are more vulnerable than other stakeholders and more likely to suffer ill health from breathing polluted air	The residents are least responsible for the generation of air quality problem. Chevron has to take responsibility for its gas flaring activities
Process	An unequal ability to choose where you live or born explain patterns of exposure	Environmental degradation could means people are generally and less able to access good sources of living	Chevron earns money from its operational fields within Ilajeland and thus need to control air pollution within area.
Justice	Everyone should have the right to a minimum standard of clean air. Monitoring of the level of compliance with standards should involve communities	Significance and priority should be set to protect the most vulnerable stakeholders. Risk assessment should incorporate multiple dimensions of impacts	Action should be taken and financed by Chevron for causing air pollution and other environmental damage in Ilajeland. The polluter must pay.

FIGURE 15: BUILDING-TRUST WITH COMMUNITIES APPROACH



10. CONCLUSION

In view of this research, gas flaring is no longer an issue that oil and gas organisations can choose to avoid; it has detrimental effects on the environment, health and safety of stakeholders in Nigeria. Thus, effective management of gas flaring could be perceived by stakeholders as indicative of good corporate governance. The findings may have confirm the thesis that gas flaring is like flaring and slaying possibly causing real trouble in the air. Gas flaring pollutes the air and thus reduces the quality of breathed air and by extension quality of life within Ilajeland and the entire Niger Delta region of Nigeria. Since breathing good quality of air is a fundamental requirement for a healthy life (Walker, 2012, p. 104), therefore, the onus is on Chevron and other oil companies to justify their continuous air pollution within Ilajeland through unending gas flaring. The continuous gas flaring within Ilajeland means that the local people would continue to be more vulnerable to adverse effects of gas flaring and living with the resultants pollution. Finally, we acknowledged that there are challenges associated with ending gas flaring immediately in Ilajeland but that Chevron could do more in view of international best practice. If not, one problematic argument that could possibly emerge is that Chevron either chooses to be more environmentally responsible or experience a similar fate with that of Shell operations in Ogoniland, Niger Delta region of Nigeria. The main lesson from this research is that oil companies will face more criticisms than ever as more evidence of the consequences of their activities on the environment and local people emerge.

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