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Forms and Effect of Environmental Degradation around Kaduna Refining and Petrochemical Company, Chikun Local Government, Kaduna State

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ABSTRACT
Trend ofenvironmentalabusein the country suggeststhat humansareprobablyheadingtowards ecological destruction.Local environmental impacts from oil refineries result from toxic air and water emissions, accidental or intentional releases of chemicals, hazardous waste disposal, thermal pollution, and noise pollution.This paper assess the forms and effects of environmental degradations around Kaduna Refining and Petrochemical Company. Both quantitative and qualitative data was used through questionnaire and Focus Group Discussion Respectively. Yamane sample size formula was used to determine 399 households around the KRPC which, was later selected purposely and the questionnaires was administered systematically. Descriptive statistics was used to analyse the data collected through the individual questionnaire and FGD by people in all communities of the study area.Evidence of different forms of environmental degradations such as water and soil pollution, erosion, deforestation and other forms of Land degradation in the area which has been attributed to the setting of KRPC. This environmental problems have health implications on the people.There is excessive timber extraction in Kazamo, which leads to increase in greenhouse gas emission as one of the major causes of climatic change that is unsustainable for biodiversity which further leads to depletion of farm land nutrient.There is need for the government to facilitate the building of industrial incinerators, engineered landfills, sewages treatment plants, municipal drainage channels, so as to control great risk and hazards to health and the ecosystem.

KEY WORDS: Forms, Effects, Environmental and Degradation

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I. INTRODUCTION

Refineries produce huge volumes of air, water, solid, and hazardous waste, including toxic substances such as benzene, heavy metals, hydrogen sulfide, acid gases, mercury, and dioxin (Texas Sustainable Energy Economic Development Coalition, 2001).There has been global concern about the quality of environment in which human beings live. TheNigerianenvironment as a resultofgasflaring andoilspills have suffered fromacidrain, desertification, chronichealth problems,greenhouseeffects,and deflection ofozonelayeretc(Nosike&Opara, 2003).

Thetrend ofenvironmentalabusein the country suggeststhat humansareprobablyheadingtowards ecological destruction.The inadvertentrelease of petroleumhydrocarbonsintotheenvironment,whetheraccidentally or throughanthropogenic activities,isa majorcause ofenvironmentalpollution.Thisposes threatstohuman health andpose potentialriskstothe atmosphere,soils,sediments,surfaceand groundwater,marineenvironmentandterrestrialecosystemsintheoil-producing host communities. And alsoineffectiveand/orunsustainableenvironmentalmanagementpracticesby the petroleumindustriesandthefailure ofNigeria'senvironmentalregulationshavecontributedto theabovementionedproblemsandsocio-economic wellbeing (Abua&Ashua,2015).Itis knownthatpetroleumrelatedenvironmentalpollution,adverse humanhealthrisksandsocio-economic problemsassociatedwithactivitiesof petroleumindustriesaroundtheworlddepend onthegeologicalandgeographicalsetting oftheoil-richhostcommunities,stagesof exploration,developmentandproductionprocessing,demography andsocio-economic activities ofthe regional

population, cultural heritage, corporate governance systems and politicaleconomy(Aniefiok*etal*.,2017).

The environmental and public health has become a prominent, but complex and multi-dimensional issue in the public policy agenda of states and international organizations. This transformation after a long period of being neglect, beginning in Rio 1992. The issue of environment today is perceived not simply as narrow ecological problem of how to ensuresymbiotic and congruent interface between man and the environment. Its inner core has psychological, political, developmental, sociological and scientific ramifications, all of which are anchored to the new concept (Kadafa, 2012).

Local environmental impacts from oil refineries result from toxic air and water emissions, accidental releases of chemicals, hazardous waste disposal, thermal pollution, and noise pollution. The petroleum refining industry releases 75% of its toxic emissions to the air, 24% to the water (including 20% to underground injection and 4% to surface waters), and 1% to the land (United State Environmental Protection Agency Office Compliance Enforcement, 2000). The primary hazardous air pollutants released by the refining industry are benzene, toluene, ethyl benzene, mixed xylenes, and n-heptane (United State Environmental Protection Agency Office Compliance Enforcement, 2000). The accumulation of refinery air emissions such as hydrocarbons, sulfur dioxide, and particulates in the atmosphere also contributes to acid rain (Epstein and Selber, 2002).

Muhammad(2006)inhisstudy onEnvironmentalImpactAssessmentofKadunaRefineryon theRidoregionofKadunametropolis, revealedthat,the refinery emittedgassuchas Sulphur dioxide, Nitrogen, Carbonmonoxide, MethaneandBenzen, theses chemical gases have serious effect on health of surrounding communities.The negative effects of petroleum industry in Nigeria showed that in the oil producing communities; Oil industries activities have continued to pose serious environmental problems affecting health, social and economic activities, sustainable development and ecological balance (Iyoha, 2008).

The refining of oilhaveaffectedhumanrighttoahealthy environmentdue toharmful/detrimentalconsequencesassociated withpetroleum-related environmentalpollutionanddegradationintheoil-producinghostcommunitieswithincrude oilsandneighbourhood ofthe Refineryarea in Nigeria. Thestudyintendstoassessand examineenvironmental effects ofKadunaOil RefineryinChikunLocal Government Area of Kaduna State, Nigeria.

1.2 DESCRIPTION OF THE STUDY AREA

TheChikunlocalgovernmentareaofKadunastateislocatedbetweenlatitude10°to11°North andlongitude7°and8°East.TheKadunarefinery occupies2.89km^2,thelocalgovernment areahasatotallandareaof(41km^2)ofthearea(figure 1).TheChikunLocalGovernmentareaisinitiallycharacterizedbyover 80%agriculturallanduse. Adewuyi&Baduku (2012) also added thatabout85%ofthelandissuitableforagriculturalcultivation.However,owingtothe Kadunarefinery,theland usepatternisfast changing.Thedecisiontoconstructthethird Nigeriarefinery inKadunawastaken in1974alongwiththesecondNNPCrefinerylocatedinWarri after the first one in Portharcourt(NNPC, 2016). Again the Kaduna Refinery was successfully commissioned by NNPC and ran at full capacity utilization (Mohammed, 2013).

However,inthepresenttime(2017)theactivities in Chikunlocal government area also reflect the commercial services, transport and infrastructuralfacilitiesarepresentinthe areasuchaselectricpowersupply, pipebornewater, good roads, banks and telephoneservice.

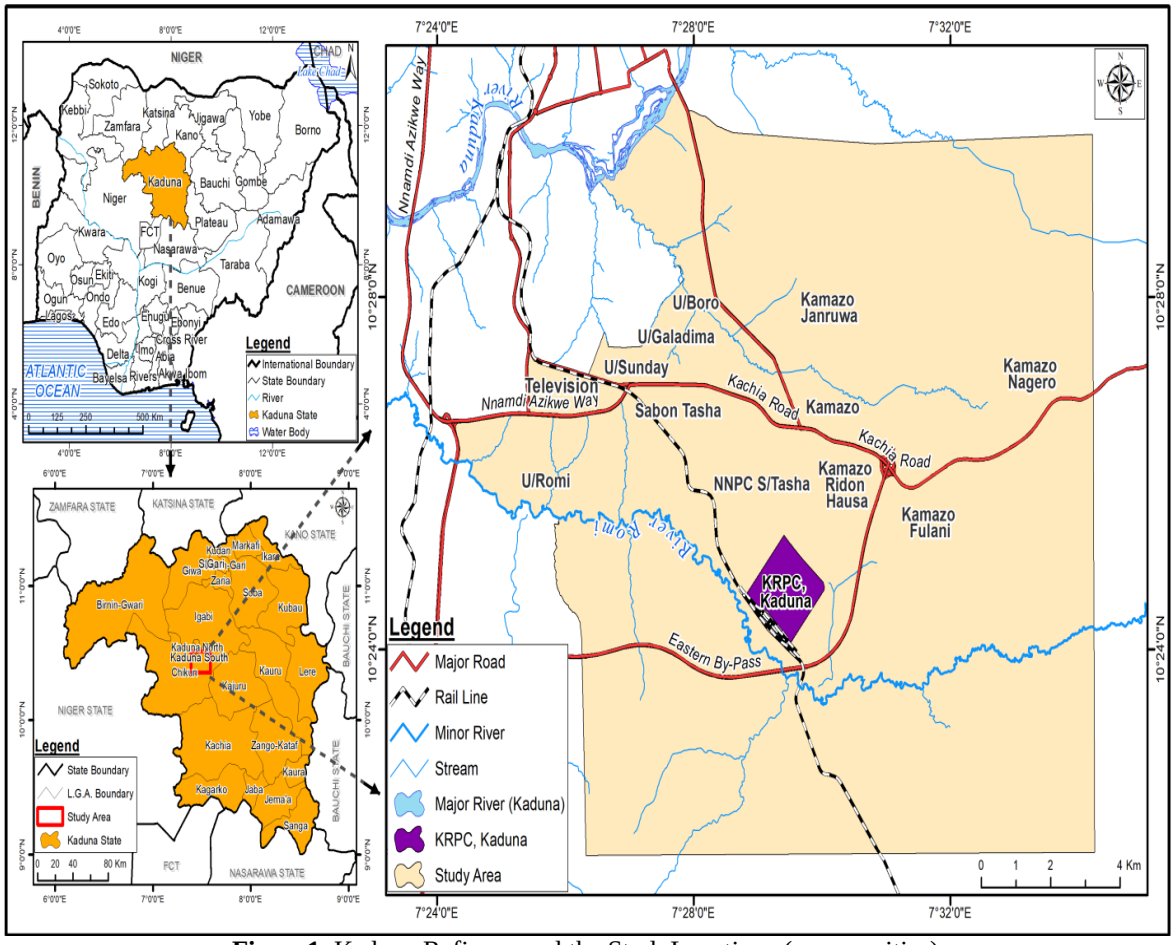

Figure1. Kaduna Refinery and the StudyLocations (communities)
Source: GIS Laboratory, Department of Geography (BUK, 2017)

2.1 RESEARCH METHOD

Reconnaissance survey was carried out in the study area in order to be acquainted with the various land use types and its people. Information on major communities, socio-economic activities, places and time of changes were surveyed. This research used both quantitative and qualitative types of data through primary sources of data generation. The primary data was sourced from questionnaire survey, the generated through questionnaire was purely quantitative. The qualitative sources of data are Focus Group Discussion (FGD).

2.2 POPULATION, SAMPLE SIZE AND TOOLS FOR DATA COLLECTION

Considering the importance of the study and the objective set, two (2) investigation tools were used: Focus group discussion (FGD) and Questionnaire.

This was used to collect data from different people on environmental effects in the communities and FGD of people was conducted on these communities for data collection and draft check list was used to guide the FGD which was designed according to the aim of this study. Eight to ten (8-10) specialist from communities at each of the four (4) communities were selected for FGD. An FGD guide was designed. Two (2) field assistant were trained to assist in conducting the FGD (i.e the leader, the secretary and the moderator). The FGD was organized with experienced people thus, experience groups. These FGD took place in all four (4) communities for data collection around Kaduna refinery.

Thetargetpopulationofthestudywere106,662 residentsinwhich399respondentsdrawnfrom thetwelvesettlementsaround Kaduna Refinery (Table 1). The population of the study is large. This warranted the need for Yamane (1976) formula for sample size. The sample size computation is shown below: $n=\frac{n}{1+n(e)^2}$

n= 399

Aquestionnairewas administeredtothreehundredandninetynine(399)respondentsinall ofthestudysettlements out of the projected household population of 106,662, based on the 1991 Census.Thereasonforusing 1991 populationcensusinsteadof2006issimply becausethe2006populationcensusdocument does not specifically differentiatelocal/communitypopulation.

Table. 1: 2016 Projected Population of the Communities around NNPC

S/No	Settlements	Projected Population (2016)	Samples Size
1	Sabon Tasha	35,497	133
2	UnguwanGaladima	3940	15
3	NNPC Sabon Tasha	6584	25
4	UnguwanRomi	19665	74
5	KamazoRidon Hausa	4206	16
6	Kamazo Fulani Danhonu II	3216	12
7	Kamazo	4074	15
8	KamazoNagero	2947	11
9	KamazoJanruwa	5113	19
10	UnguwaBoro	4187	16
11	Unguwan Sunday	6265	23
12	Television	10968	41
	Total	**106,662**	**399**

Source:NPC,1991

2.3 METHOD OF DATA ANALYSIS

Descriptive statistics was used to analyze the data collected through the individual questionnaire and FGD by people in all communities of the study area. Charts and tables were used for data presentations.

3.1 RESULT AND DISCUSSION

3.1.1Forms and Effects of Environmental Degradation

The participants revealed that there was occurrence of different forms of pollution in the whole study area from 1994 to 2014. In 1994, 2004 and 2014 there was outbreak of cholera in Sabon Tasha due to water pollution caused by discharge of waste water into the environment, in Kamazo, Marabanrido and NNPC Sabon Tasha in the year 1989, 1994 and 2004 respectively experience water pollution in those communities caused by waste water disposal which lead the outbreak of diseases such as Typhoid, Diarrhea and Hepatitis as confirmed from the Focus Group Discussion (Table 2). These diseases are known to be caused by unclean water contaminated with faecal matter if not treated on time might lead to epidemic within the affected communities (WHO, 2002).

Air pollutants are usually classified into suspended particulate matter (PM) (dusts, fumes, mists, and smokes); gaseous pollutants (gases and vapors); and odours. In the study area in the year there was outbreak of Asthma in NNPC Sabon Tasha in the year 2004 and 2014 caused by Burning of crude oil leading to air pollution. Communities like Kamazo and Sabon Tasha experienced increase in the prevalence of skin disease and lung cancer which is the result of air pollution. This form of pollution is common where there is refinery and oil spillage or burning of substances which release poisonous fumes in to the immediate communities as confirmed by the Focus Group Discussion.

Declined land fertility, Erosion and Loss of land structure caused by Loss of land structure, and Industrial waste, as a form of land pollution is common in all the study area which took place at different point in time. This kind of pollution occurred due to lack of proper disposal of waste from both the households in the different communities and the oil industries. There are records of noise pollution in the study area caused by Power plants which leads to hypertension, disturbance in sleep and hearing impairment. However the pollutions causes several health diseases and environmental degradations in the immediate communities. This findings correspond to that Muhammad (2013) which stated that, the physical hazard originated from the refinery production process is pollution of air, water and land.

Table 2: Cause and Effect of Pollution in the Area

Types	Causes/sources (in order of magnitude)	Possible Health Effects (in order of severity)	Area of occurrence (date)
Water Pollution	Discharge from Waste water Water disposal Petrochemical plants	Cholera Typhoid Diarrhea Hepatitis	Sabon Tasha (1994, 2004, 2014) Sabon Tasha (througout) Kamazo (1989) MarabanRido (1994)

			MarabanRido (2004) NNPC Sabon Tasha (2014)
Air Pollution	Burning of fossil	Asthma	NNPC Sabon Tasha (2004, 2014)
	Carbon emission	Skin diseases	Kamazo (2004,2014)
	Acid rain	Lung cancer	Sabon Tasha (1984, 1994) Sabon Tasha (2014) MarabanRido (2014) MarabanRido (2018)
Land Pollution	Household garbage Industrial waste	Loss of land structure Erosion Decline land fertility	Sabon Tasha (throughout) Kamazo (throughout) NNPC Sabon Tasha (2004)
Noise pollution	Power plants Power plants Power plants Power plants	Hypertension Hearing effect Disturbance (Sleep)	Kamazo (2004) Sabon Tasha (2004) MarabanRido (1994) NNPC Sabon Tasha (1994)

Source: Field work, 2018

3.1.2 Causes and Effect of Erosion around KRPC

The respondents revealed that there is decline of soil quality in Sabon-Tasha, the land structure was sediment with top soil bars due to land degradation that was caused by water erosion (Table 3). Some participants revealed that factors contribute to the occurrence of soil erosion in the areas includes soil type and its characteristics, topography, geology, cultural practice carried out in the region and conservative practice applied to the land (Table 3).

The respondents' revealed thatin Kamazo there is decline in soil quality, sediment was caused by water erosion and relief which was as a result of land clearing by different household in the study communities. In fact there is serious degradation of land in the whole area caused by this water erosion (Table 3). The Study was supported by Iyoha (2000) who stated that, the negative effect of petroleum industry in Nigeria, caused serious environmental effects in the area such as erosion, land degradation and land pollution.

Table 3: Causes and Effects of Erosion in the Four Communities around KRPC

Communities	**forms**	**Possible causes**	**Effects**
Sabon Tasha	Gullies Erosion	Water erosion	The decline of soil quality
Sheet Erosion		Relief	Sediment wash
Scanty Vegetation		Deforestation	Bare soil and Devegetate
NNPC Sabon Tasha	Sheet Erosion	Relief	Sediment wash
Gullies Erosion		Water Erosion	Decline of soil quality
MarabanRidoSheet Erosion		Relief	Sediment wash
Kamazo	Sheet Erosion	Relief	Sediment wash
	Gullies Erosion	Water erosion	The decline of soil quality

Source: Field work, 2018

3.1.3 Causes and Effects of Other Land degradation around KRPC/NNPC

The participants revealed that human factors are the major causes of land degradation in the four communities, like in Sabon Tasha the major cause of land degradation and the side effect soil acidification. The commercial development in MarabanRido leads to the clearing of more lands and later resulted in depletion of soil nutrients. In Kamazo communities overgrazing and land clearance are the two major causes of land degradation, the degradation of the land in that communities comes in form of desertification then soil erosion (Table 4). Evidence of desertification and soil erosion includes the drop in agricultural productions in the areas and the loss of agricultural employment opportunities. The study was supported by Poesen and Valentin, (2003) who stated that excessive clearing, inappropriate land use and compaction of the soil caused by grazing often leave the soil exposed and unable to absorb excess water. Surface runoff then increases and concentrates in drainage lines, allowing soil erosion to develop in susceptible areas.

Table 4: Causes and Effects of Land Degradation in the Four Communities around KRPC

Area	Causes/sources	Effects
Sabon Tasha	Urban sprawl	Flood
		Soil acidification
NNPC Sabon Tasha	Vehicle off-roading	Soil acidification
		Soil erosion
MarabanRido	Commercial development	Desertification
	Agricultural depletion of soil nutrient	Flood
Kamazo	Overgrazing	Desertification
	Land clearance	Soil erosion

Source: Field work, 2018

3.1.4 Evidence and effects of Deforestation in KRPC/NNPC

The participants revealed thatSabon Tasha communities causes of deforestation and the loss of trees composition was due to the construction of industries. Before the construction of the industries there must be clearance of lands that leads to loss of biodiversity, this is the common features in any urban communities. The construction of industry in NNPC Sabon Tasha all leads to decrease in the natural beauty of the community, couple with the facts that there are proper regulation of use of land in the study community (Table 5). In MarabanRido which is a bit of a suburban area, the land degradation in that community is as a result of increase in soil erosion caused by Agricultural expansion. Once there is population growth in any community, there is also need for expansion of agricultural land or alternative technology to feed the growing population.

Excessive clearing and tillage of lands for agricultural activities were often leave the soil exposed and unable to absorb excess water. Surface runoff increases drainage lines, allowing soil erosion to develop in those areas (Poesen&Valentin, 2003). The respondents revealed that there is excessive timber extraction in Kazamo, which leads to increase in greenhouse gas emission as one of the major causes of climatic change that is unsustainable for biodiversity which further leads to depletion of farm land nutrient (Table 5). This is a major side effect that is common globally and need to be addressed because the depletion of this natural resources results into emergence of some health challenge which affects humans.

Table 5: Causes and Effects of Deforestation in the Four Communities around KRPC

Area	Causes/sources	Effects
Sabon Tasha	Construction of industry	Loss of biodiversity
NNPC Sabon Tasha	Construction of industry	Decreases the natural beauty of an area
MarabanRido	Agricultural expansion	Increase soil erosion
Kamazo	Timber extraction	Increase greenhouse gas emission

Source: Field work, 2018.

4.1 CONCLUSION AND RECOMMENDATIONS

Evidence of different forms of environmental degradationssuch as water and soil pollution, erosion, deforestation and other forms of Land degradation in the area which has been attributed to the setting of KRPC. This environmental problems have health implications on the people.

It is obvious and in our best interest that this country must adopt measures that would provide reasonable degree of protection of its ecological human environment from pollution, whether it emanates from the oil industry or other sources. Such measures should discourage discharge of harmful effluents and emissions, into the environment through the adoption of appropriate prevention techniques using the most effective and current technologies on erosion control. The human resource is the greatest resource endowment of any nation and must be protected.

There is need for the government to facilitate the building of industrial incinerators, engineered landfills, sewages treatment plants, municipal drainage channels, so as to control great risk and hazards to health and the ecosystem.

Soil nutrient reserve should be improved. This involved the control in heavy metals from the soil through the increase in compost and organic materials in the soil.

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