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EH&S Management versus Hydrocarbon and MSW Pollution of Environmental Resources

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ABSTRACT: Effective insurance to EH&S within the socioeconomic environment describes positive human activities towards both natural and artificial environmental resources and its management processes. These are mostly not taking very seriously in the developing nations today. Assessing fewer of these natural resources (soil and water), it can be deduced that environmental degradations are the order of the day, health issues are not much government pilots concerns, equally pollutions has taking virtually all social human rights while safety is left in the hands of the creator with no individual efforts to salvage the situations except for few individuals and supporting agencies. Evaluating the physiochemical, bacteriological states as well as THC, UCM,CPI among other TPH compounds in soils and drinking water within 8 different communities, the results not only just worrisome but highly detrimental to the survival of both human, animal, plants and the ecological system, detailed results through laboratory analysis of 32 physiochemical parameters and 3 bacteriological counts in drinking water for THC, E.coli and Faecal coliform in the North-Central Nigerian communities table 4, 5 and 6, figure 5a, 5b, 5c and 5d respectively. Including 15 major TPH compounds such as (1, 2-DCB),(1, 3-DCB), (1, 4-DCB). (M, p-xylene), (PAHs), Benzene, and xylene. While trace elements includes Cadmium, Chromium, Lead and Zinc among others analysis in both hydrocarbon contaminated soil and drinking water in the South-South Nigerian region.Major compounds examined shows higher concentration above international recommended not just minimum but over the maximum allowable limits of concentrations when compared with standards spelt out by WHO, ISO, USEPA, WSDE, USDHHS, KDHE, EUEPA, EGASPIN, NAFDAC, NOSDRA, NSDWQ etc.

KEYWORDS: Contamination, Environment, Flooding, Physiochemical, Bacteriological, Hydrocarbons, and Mitigation.

I. INTRODUCTION:

The natural environment is an ecological system encompassing the living and non-living natures surviving symbiotically in an immeasurable land (wet and dry lands, green vegetation, the atmosphere, climatic condition and weather). Hence, the social and economic interaction between these natural interphase can positively or negatively affects the quantity or the quality of one from the other. Therefore, to safeguarding the harmonious coexistence of these natures, an effective but sustainable environmental protection of the lands, water bodies, vegetation, and all other forms of organisms as well as the available environmental resources needed to be prioritised, in accordance with environmental sustainability golden triangle (the environments, economy and the general society) [1] and [2]. Its however important to note that, human nature are the major source to environmental resources depletions when compared to any other organisms and or certain phenomena. However, this can be attributed to the human quest for mining natural resources for energy productions and power generation, and to build or erect cities, factories and industries, as well as the use of transportation systems for both societal and economical satisfactions, with little or no much consideration is attached to environmental sustainability by the major players and the stakeholders of these industries. Similarly, only 37 countries had pledged their commitment to lowering by 5.2% the amount of GHGs emission in their respective countries effectively by 1990 through 2008 and 2012 as well as to attain success bench mark by 2020 and or 2050, with the objective to creating ERP within the developing countries so as to earn free carbon credits known as CER credits, aimed at providing relief to developing nations without the technical capacity to combating climatic changes within their rich. It's technically known that, parts of Asia, Europe and North America are the most industrialized nations responsible for the current scenario of global warming due to GHGs and VOCs emission. Hence, the present industrialized countries pledges to cutback global emission are not adequate to mitigating the current global emission rise, therefore It's worrisome, that the existing initiative to ensuring environmental sustainability and BPEO is not embraced by the major world industrialised nations, and one of the foremost detrimental effect is global warming syndrome [3], with several environmental footprints that are ravaging the developing nations at large, taking Nigeria for instance, there are over 20 multinational oil and gas companies operating in Nigeria, and the top ten are owned by the developed nation table 1 below [4].

Table 1: First ten ranked oil & gas companies operating in Nigeria

S/No.	Companies	Headquarter(s) / Country of Origin	No. of countries with operations presence
1	Exxon Mobil	Texas, USA	Over 200 countries
2	Chevron	San Ramon, California, US	Over 84 countries
3	Statoil	Stavanger, Norway	Over 30 countries
4	Shell	Hague, Netherlands	Over 70 countries
5	Agip Oil	Rome, Milan, Italy	Over 21 countries
6	Petrobras	Rio de Janeiro, Brazil	Over 27 countries
7	Total	Courbevoie, France	Over 130 countries
8	Hardy Oil & Gas	Aberdeen, UK	More than 3 countries
9	Nexen Inc.	Calgary, Alberta, Canada, China	More than 4 countries
10	Addax Petroleum	Beijing, China	More than 6 countries
Source: [4] and [5]			**Source:** companies websites

However, their operational activities today around the globe, are the major contributing factors for the release of GHGs and the main sources for global warming, when compared to ineffective MSW, industrial and chemical wastes disposals [3], other similar articles includes; [6], [7], [8] as well as [9], [10]. Nigeria is not an exceptional, as these companies' activities are the principal factor for environmental degradation in the South-South, South-East and fewer parts of the South-West geopolitical regions of Nigeria, having an approximate human populations of; table 2. Major affected ecological structures in these regions are basically; the loss to aquatic lives and biodiversity, contaminations of agricultural lands, as well as both surface and underground water bodies in the likeness of rivers, creeks, ponds and open dug wells etc. it's equally important to note that most of these water bodies are easy collection points for spilled crude oil by the locals as means for survivals, as evident in figure 1. Similarly, these rivers, creeks, ponds and open dug wells remains the only sources for drinking water as well as for domestic activities in the rural areas of these regions, figure 2.

Table 2: Nigerian 2016 geopolitical zones population figures

Six Nigerian Regions / Zones	2016 Population Census	2020 Comparable Countries Populations
North-West	48,942,307	Colombia
South-West	46,706,662	Spain
North-Central	29,252,408	Nepal
South-South	28,829,288	Venezuela
North-East	26,263,866	Cameroon
South-East	21,955,414	Sri Lanka

Source: (Nigerian National Bureau of Statistics, 2020)

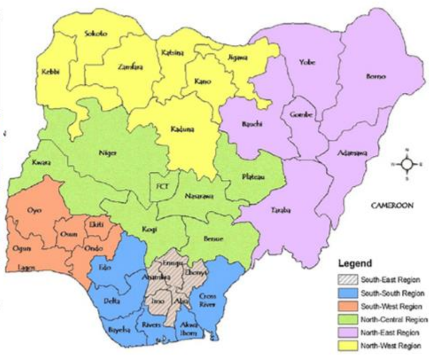

Fig. 2a) Crude Oil spills in the South-South and South-East Nigerians river and

Fig. 2b) Oil spills flows in Ogoni river land,

Fig. 2c) Oil spills Sombrero river for Agba Ndele, the only major drinking water source

Figure 2: Contaminated water bodies due to crude oil spills, the South-S and South-East Regions of Nigeria
Source: [11], [12] and [13]

However, it's evident, the locals are faced with lack of social and infrastructural developments characterised by ravaging poverty for decades of oil explorations, that are influenced by either or both of intentional and or accidental human factor(s). The locals had lost the only source to their livelihoods which are farming and fishing activities, as a result of absolute contamination of the available farmlands and water bodies, without due considerations for environmental reclamation or remediation processes [14], other related publication includes; [15], [16], [17], similar other articles are; [18], [19], and [20]. However, according to [21] statistical data shows, from the year 1970 to 2000, 7,000 numbers of oil spillage had occurred and were recorded, and by January 2005 to July 2014, there were records of 5,296 numbers of oil spillage according to Nigerian Oil Spill Monitor.

Similarly, one of the oil corporation (Royal Dutch Shell) operating in Nigeria had admitted to have spilled almost 14,000 tonnages of crude oil, an equivalent of 100,000 barrels in the year 2010, affecting 4 LGAs and in 18 host communities of the oil-rich Ogoniland figure 2b.

According to [22], NOSDRA had recorded 1,930 oil spilled in Niger-Delta offshores wetlands during the periods; 2013, January to 2014, September respectively, and similarly the Italian oil giant (ENI) cooperation had admitted to have spilled more than 550 times crude oil in the year 2014. These occurrences are due to lack of facility routine inspections and maintenances as well as deliberate act [2] and [14]

Furthermore, it's equally important to note that the ecosystem cannot thrive without the existence of clean, portable and palatable water for the consumption of both plants and animal. Water remains to be the most valuable and utmost important natural resources alongside air and soil, above any other form of resources in used [23]. Similarly, majority of the water bodies were adversely affected due to runoff activities, which washes MSW, fertilizers, pesticides and chemical wastes into surface water bodies figure 3a and leachate which pollutes ground water tables, these are implications of having refuse located nearby settlements and upstream tributaries, distributaries and watercourses figure 3b [24], [25], [26], [27] and [4], other related MSW leachate impacts includes; [28] and [29]. Water has no substitute in its many uses, it however supports all forms of lives and industrial uses [23]. Majority of the communal settlements of the rural areas in all the 6 geopolitical zones in Nigeria are faced with sever water scarcity, from just very little or no water to drink, or very plentiful but hard water or completely polluted with MWS or leachate, chemical and industrial wastes as well as pollutions due to mining activities and hydrocarbons [30], [31], [32], and [4]. However, it's worrisome to note that 85 -95% of the available streams and ponds used in the rural areas, are heavily polluted by spirogyra, agricultural activities (chemicals fertilizers & pesticides), dumping of garbage into water channels/drains and streams as well as transportation of human faeces due to general practice to open defecation by surface runoff during rainfall [4], figure 3a and 3b respectively.

Fig. 3a): A pregnant woman fetching drinking water from a stagnant stream

Fig. 3b): Section of washed refuse dump upstream river flow Keffi LGA (North-Central zone)

Figure 3: One out of many rural communities in Nigeria versus health and water quality
Source: [32] and [4]

Furthermore, the rate of environmental degradation caused as a result of surface runoff due to blockage of water channels and drains, resulting from dumping of refuse or garbage in the water ways is unquantifiable. However, major consequential effects are; ravaging over flooding of cities, villages and towns figure 4a – 4e [39], [40] and [41], the presence of soil degradation and erosions [42], [43] and [44], damage on marine foods and livestock, complete loss of farmland and produce leading to food insecurity [45], [46], [47], [48], and similarly [49], [50] as well as [51], [52], [53] and [54] equally there is gross loss of shelters. Others includes; contamination of available portable drinking water sources, outbreak of incessant and infectious diseases [55], [56], [57], and [58], hunger and ravaging poverty among others [4].

Fig. 4a) Flash flood incident at Ikorodu-Sagamu road Lagos state, South-Western Nigeria

Fig. 4b) Abuja flooding swiped away five family, (FCT) North-Central Nigeria

However, natural phenomena such as global warming due to GHGs effects [8], are contributing factors to these effects of flooding as a result of persistent rainfall as in the other parts of the globe, but it is not the case in Nigeria, as year 2020 is generally assessed to be a year that had not experienced incessant rainfall but instead characterised by, lesser to moderate rainfall. Hence, major contributing factor to these flooding is as a results of the existence of several barriers (artificial built illegal structures and hips of refuse dumps) [3] and [59], obstructing free flow of fluids through the drain channels and natural watercourse [4] and [37]. Similarly, according to NEMA as at June to

September 2020, a total of 27 out of the 36 sates of Nigeria including the FCT had been devastated by the flooding disaster, and SEMA are unprepared to handle the situations.

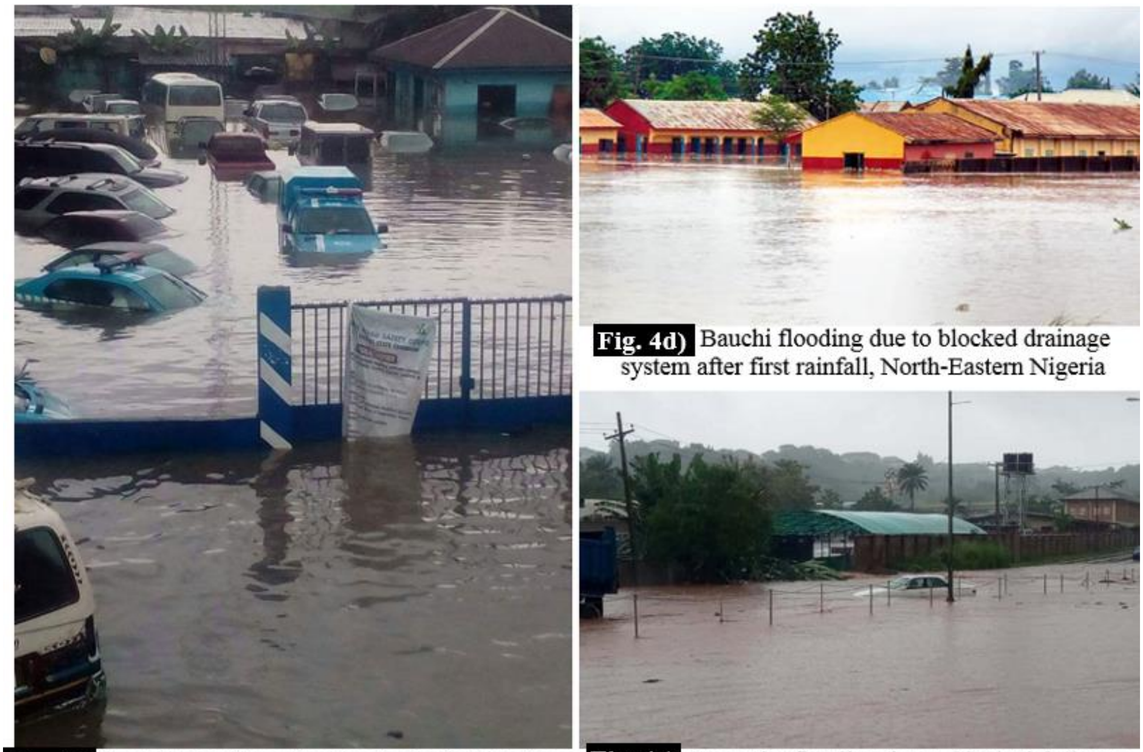

Fig. 4c) Port Harcourt flooding due to blocked drainage system after heavy rainfall, South-South Nigeria

Fig. 4d) Bauchi flooding due to blocked drainage system after first rainfall, North-Eastern Nigeria

Fig. 4e) Kano city flooding due to blocked drainage system after heavy rainfall, North-Western Nigeria

Figure 4: Effect of blocked drainages by wastes resulting to flooding in major cities in Nigerian geopolitical zones, 2020 scenario

Source: [33] [34], [35], [36] and [37]

II. PROBLEM STATEMENT:

Public waste management coupled with EH&S including accessibly to portable drinking water are a major concern and problems for decades yet on solved, facing not only the rural communities, including some of the Nigerian urban settlements. It's equally important to highlight the indiscriminate use of reserved green areas and water ways for physical construction vice-versa global warming phenomena which are major causes for over flooding during and after rainfall in all the 6 Nigerian geopolitical zones. However, the rate of contamination, negative health effects and losses caused by the aforementioned scenarios within the affected communities, are generally not just only worrisome but threatening to the harmonious coexistence of human beings, animals and the ecological environment at large. Therefore, national and international stakeholders' participation to effective address and mitigates, these causes is utmostly and promptly needed.

AIM AND OBJECTIVE:

This research aimed at analysing major EH&S problems as well as to qualitatively and quantitatively examine the extent of environmental contaminations of soil and water due to hydrocarbon and MSW activities from some sampled communities in the North-Central and the South-Southern Nigeria. Major objective is to examine the degree of pollutions, and the health implications that can be associated to both biological existence and the ecological environment.

RESEARCH MATERIALS:

The major materials utilised in the cause of this research are basically:

- The randomly collection of six (6) soil samples at 3 different research sites from the South-South region, weighing approximately 1 - 2 kg each in 6 polymer gags labelled for site one (A1,

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A2); site two (B1, B2) and site three (C1 and C2) respectively;

- Three (3) samples of streams water for domestic uses measuring one (1) litre each were collected from 3 different localities in the South-South region; Three (3) samples of stream water for domestic uses measuring one (1) litre each were also collected from 3 different localities in the North-Central region; and
- Laboratory reagents for biochemical analysis.

RESEARCH EQUIPMENTS:

The major research equipment employed includes; sets of physical test equipment, clinical and raw material research laboratory equipment were used in analysing the nature and extents of pollutions that can be associated with individual research specimens collect from both aforementioned regions.

III. METHODOLOGY:

The methodology employed in the cause of this research work is basically in line with internationally recognised standards (APHA, API, ASTM, CCME, EGASPIN/DPR, EUEPA, FMENV, KDHE, NAFDAC, NSDWQ, USDHHS, USEPA, WHO, WSDE etc.) methods for Physicochemical, Bacteriological and Hydrocarbon content in soil and water, these includes the following procedures: [60], [61], [62], [63], [64], [65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75], [76], [77], [78], [79], others among these methods also includes: [80], [81], [82], [83], [84], [85], [86], [87]¸ [88]¸ [89], [90], [91], [92], [93], [94], [95], [96], [97], [98], [99], as well as [100], [101], [102], [103], [104] ,[105], [106],[107], [108], [109], [110], [111], [112], [113], [114], [115], [116], [117] and as summarised in table 3 below.

Table 3: Summary of analytical parameters and methodology

S/No.	Parameters	Methodological analysis
1	**Physical analysis of samples:** Temperature in (ºC); pH value; Electrical conductivity (µs/cm); and Turbidity (FTU); Colour (Pt./Co); Odour (OTN);	Instrumental set of test kit used to analyse test samples immediately on site, during sample collection process such as: Conductivity Meter Aqualitic; Multi-parameter and Nephelometric method (Multi-parameter Photo flex Turb Sets).
2	**Chemical analysis:** Fluoride; Cadmium; Chromium; Copper; Calcium; Chloride; Lead; Magnesium; Phosphate; Sulphate; Iron; Nitrate; Total Dissolved Solid (TDS); and Total Hardness. Units of measurements are, (Mg/l)	Technical laboratory application of Potentiometric method (Ionometer); and Photometric method (Photo flex Turb Sets). Vice-versa other major experimental methods.
3	**Bacteriological analysis** E-coli enumeration/ml	Application of method 1604: (Total Coliforms and Escherichia coli in Water by Membrane Filtration) Using a Simultaneous Detection Technique (MI Medium) as well as other supplementary methods.
4	**Petroleum Hydrocarbon content** Total Petroleum Hydrocarbon (TPH)	Methodologies employed includes: Gravimetric Analysis (EPA 1664); Solid Phase Extraction (SPE) distilled at 85 °C; Rapid Field Analytical Methods (RFAM) for TPH in soil; as well as TPH as gasoline and diesel Method 8015B among several methods.

IV. RESULTS & DISCURSIONS:

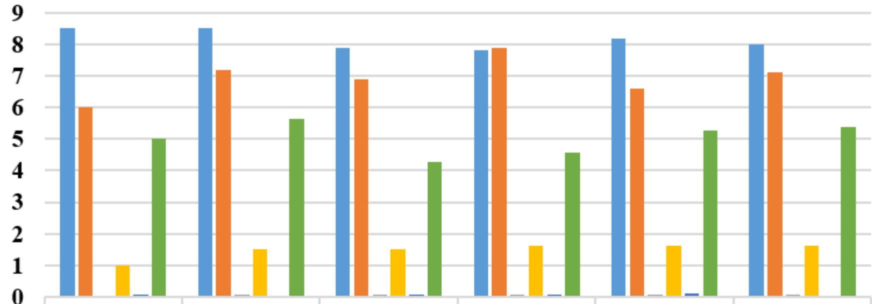
Table 4: Physicochemical and Bacteriological analysis of streams water for domestic consumptions in North Central State

Physicochemical Examination of Specimens					
Analytical Parameters	**Specimen A**	**Specimen B**	**Specimen C**	**Specimen D**	**Specimen E**
pH	8.50	7.90	7.80	8.20	8.00
Temperature (°C)	27	26.50	27	26	27
Colour (Pt./Co)	53.50	55.00	54.00	48.50	50.00
Turbidity (NTU)	66.50	55.90	59.5	62.53	47.80
Taste and odour	Muddy	Mild	Mild	Muddy	Mild
Conductivity (µS/cm)	2725.00	2650.50	2850.00	2775.5	2650.5
Sodium (mg/l)	108.50	91.70	59.90	32.00	72.80
Total Dissolved Solids (mg/l)	1602.2	1555.8	1675.5	1426.4	1140.0
Total Suspended Solids(mg/l)	624	595	589	618	549
Total Alkalinity($CaCO_3$) (mg/l)	225.00	210.50	225.50	195.50	105.00
Total Hardness (mg/l)	45.50	40.00	42.50	39.80	41.50
Total Iron (mg/l)	0.72	1.52	0.79	1.02	0.72
BOD (mg/l)	7.23	6.87	7.88	6.63	7.06
Calcium Hardness (mg/l)	26.50	23.50	28.00	23.00	24.50
Magnesium Hardness (mg/l)	40.50	35.55	41.00	37.00	35.50
Calcium (mg/l)	10.50	9.55	8.50	9.25	9.00
Magnesium (mg/l)	11.55	10.5	9.50	10.00	8.95
Nitrate-Nitrogen (NO_3-N) (mg/l)	47.21	46.87	49.23	47.55	46.22
Fluoride (mg/l)	1.25	1.00	0.85	1.50	1.25
Chloride (mg/l)	257.26	251.55	256.00	261.00	257.25
Silica	125.80	132.83	97.35	65.59	99.47
Sulphate (mg/l)	0.98	0.45	0.52	0.48	0.39
Ammonium Nitrogen NH_4 (mg/l)	0.55	0.38	0.41	0.37	0.44
Arsenic (mg/l)	0.06	0.05	0.06	0.05	0.04
Potassium (mg/l)	17.25	15.55	15.05	14.25	16.55
Phosphate (mg/l)	0.25	0.20	0.18	0.25	0.26
Aluminium (mg/l)	0.29	0.22	0.20	0.18	0.13
Copper (mg/l)	1.53	1.45	1.57	1.55	1.58
Lead (mg/l)	0.04	0.08	0.06	0.09	0.03
Selenium (mg/l)	0.06	0.05	0.06	0.06	0.06
Cyanide (mg/l)	0.00	0.00	0.00	0.00	0.00
Zinc (mg/l)	5.65	4.26	4.57	5.27	5.39
Bacteriological Examination of Specimens					
Total Heterotrophic Bacteria (cfu/ml)	54.25	38.32	42.58	36.55	28.55
E.coli (thermotolerant Coli) (cfu/ml)	5.25	1.23	3,55	1.25	2.58
Faecal Coliform (cfu/ml)	4.05	0.28	0.32	1.46	1.55

***BOD:** Bio-chemical Oxygen Demand

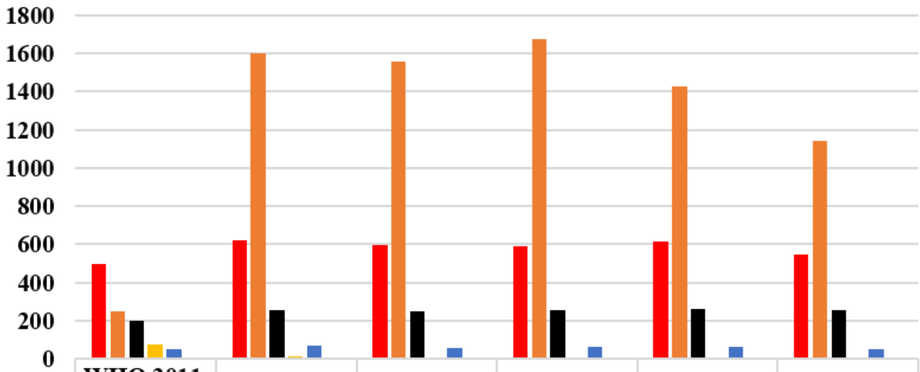
Specimen A, B, C, D and E are major distributary flowing from upstream towards downstream having several tributaries connections, which are used by several communities as source for drinking water and for other domestic used during dry and raining seasons. Similarly, the interval between one specimen collection sample and the others are: A to B is 5 km; B to C 3 km; C to D 2.7

km and D to E 5 km respectively. It's equally important to note that, this stream serves as major grazing and pasturing of animals by nomadic, and a collection as well as catchment basin for the surrounding surface runoffs from several waste dumpsites and agricultural farmlands, this is a general phenomenon that are associated with virtually all streams and rivers in the northern part of the country. However, majority of the villages and towns settlements around this stream directional flow are dependant to its fluid resources as the only major source for domestic water sources, in all ramifications this water does not fit for domestic uses in its physical states. Hence, it deem necessary to undertake both Physiochemical and bacteriological quality analysis of this stream in order to ascertain the degree of water contamination used by these communities.



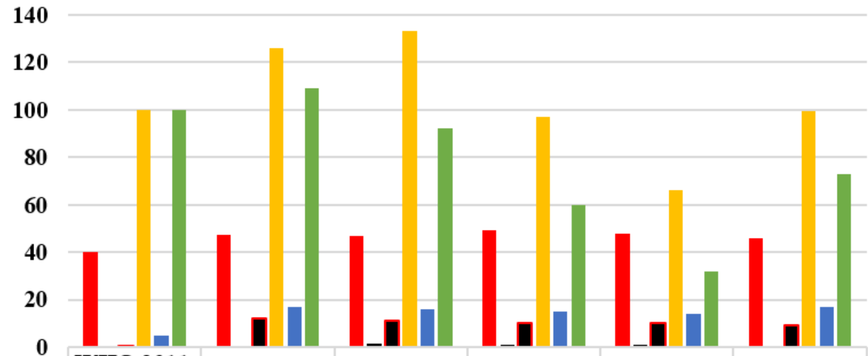
	WHO 2011 Max. Limit	SP-A	SP-B	SP-C	SP-D	SP-E
pH	8.5	8.5	7.9	7.8	8.2	8
BOD	6	7.2	6.9	7.9	6.6	7.1
Selenium	0.01	0.06	0.05	0.06	0.06	0.06
Copper	1	1.5	1.5	1.6	1.6	1.6
Lead	0.05	0.04	0.08	0.06	0.09	0.03
Zinc	5	5.65	4.26	4.57	5.27	5.39

Fig. 5a): Physicochemical Parameters of Stream Drinking Water in Rural Keffi LGA



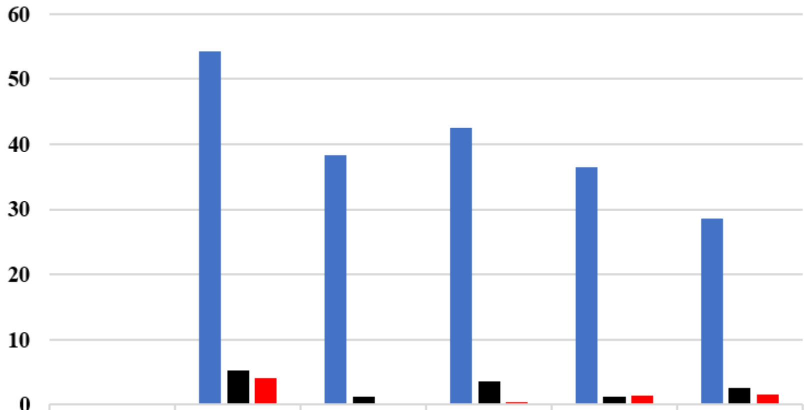
	WHO 2011 Max. Limit	SP-A	SP-B	SP-C	SP-D	SP-E
TSS	500	624	595	589	618	549
TDS	250	1602	1556	1676	1426	1140
Chloride	200	257	252	256	261	257
Calcium	75	11	10	9	0	9
Turbidity	50	67	56	60	63	48
Aluminium	0.2	0.29	0.22	0.2	0.18	0.13

Fig. 5b): Physicochemical Parameters of Stream Drinking Water in Rural Keffi LGA



	WHO 2011 Max. Limit	SP-A	SP-B	SP-C	SP-D	SP-E
Nitrate	40	47.2	46.9	49.2	48	46
Iron	0.3	0.7	1.5	0.8	1	0.7
Manganese	0.1	12	11	10	10	9
Silica	100	126	133	97	66	99.5
Potassium	5	17	16	15	14	17
Sodium	100	109	92	60	32	73

Fig. 5c): Chemical Parameters of Stream Drinking Water in Rural Keffi LGA



	WHO Max. Limit	SP-A	SP-B	SP-C	SP-D	SP-E
Total Heterotrophic Bacteria	0	54.25	38.32	42.58	36.55	28.55
E.coli (thermotolerant Coli)	0	5.25	1.23	3.55	1.25	2.58
Faecal Coliform	0	4.05	0.28	0.32	1.46	1.55

Fig. 5d): Bacteriological Parameters of Stream Drinking Water in Rural Keffi LGA

Therefore, table 4, figure 5a, 5b and 5c, above shows the results of the parameters investigated. Apparently, in general terms virtually all the parameters in specimen ‘A’, ‘B’, ‘C’, ‘D’ and ‘E’ did not conforms to any available minimum global acceptable standard (WHO, USEPA, ISO, EUEPA, NAFDAC, NSDWQ etc.). Hence, it can be depicted from the plotting in the above figures that there are greater variation with global international minimum and maximum allowable concentrations limits, except for the values of Sulphate in specimen ‘A’ to be (0.98 mg/l) and Cyanide (0.00 mg/l). While specimen ‘B’ had similarly, Sulphate (0.45 mg/l), Arsenic (0.05 mg/l), while others are Selenium with (0.05 mg/l), Cyanide (0.00 mg/l) and Zinc having (4.22 mg/l) concentrations. Other parameters that have meat minimum international standards from specimens ‘C’ are as follows; Sulphate (0.48 mg/l) Aluminium (0.20 mg/l), Cyanide (0.00 mg/l) and Zinc (4.57 mg/l) and for specimen ‘D’ are Sulphate (0.48 mg/l), Arsenic (0.05 mg/l), others includes) and Cyanide (0.00 mg/l). however specimen ‘E’ also had the following parameters which falls within the minimum acceptable limits of concentration in drinking water, these includes; Sulphate (0.39 mg/l), Arsenic (0.04 mg/l) and lastly Cyanide with (0.00

mg/l) respectively. Therefore, in line with these analytical chemical parameters result, it can be said that the stream water at this settlements does not fit for drinking as it has several health implications that can affect both humans, plants and animals, if not immediately but in the lifetime.

Furthermore, the stream water at all points of collections had an excess BOD concentration of 7.23 mg/l, 6.87 mg/l, 7.88 mg/l, 6.63 mg/l and 7.06 mg/l, these concentration clearly explains the presence of effluence discharged in to the stream by the activities of open defecation, households and industrial discharged processes. Hence BOD is applicable in determining the amount of oxygen required for the stabilization of wastes emanating from residential and industrial activities. It's equally important to note that, the concentration of NO_3-N in these five (5) water samples, exceeds the international standard requirements i.e. as against WHO limit of 40 mg/l when compared to; 47.21 mg/l, 46.87 mg/l, 49.23 mg/l, 47.55 mg/l, and 46.22 mg/l, this is also an indication for the several farming activities that are practiced within the hilly and surrounding stream area, which contributes immensely to the increasing NO_3 concentrations in the water samples. Subsequently, these will limit the availability of oxygen demands, and can affect the existence of aquatic species, plants as well as algae. While the consequential effect in human is it does cause "Blue baby syndrome disease" as a result of the reactivity between NO_3 and Fe and the red blood cells, which creates methemoglobin that halts the level of oxygen in humans usually under aged children 12 months does severely suffers most from consuming NO_3 polluted water.

Further analysis of the bacteriological examination of specimens 'A', 'B', 'C', 'D' and 'E' for both Total heterotrophic bacteria, E.coli (thermotolerant Coli) and Faecal Coliform, didn't meet up with the bacteriological counts minimum standards spelled out by either of WHO, USEPA, ISO, EUEPA NAFDAC, NSDWQ, as it can be seen from table 5 and figure 5d above, the values exceeded the requirement established by the international standards and regulatory bodies (0/100 ml). While for Total heterotrophic bacteria (THB) in specimens 'A', 'B', 'C', 'D' and 'E' are 54.25cfu/ml, 38.32 cfu/ml, 42.58 cfu/ml, 36.55 cfu/ml, and 28.55 cfu/ml' likewise for E.coli (thermotolerant Coli) are; 5.25 cfu/ml, 1.23 cfu/ml, 3,55 cfu/ml, 1.25 cfu/ml, and 2.58 cfu/ml. While for Faecal Coliform counts the values are; 4.05 cfu/ml, 0.28 cfu/ml, 0.32 cfu/ml, 1.46 cfu/ml and 1.55cfu/ml. However, the presence of Heterotrophic bacteria (HB) aren't indicator for pathogenic condition, except for Pseudomonas being an opportunist which are contagions and can cause harm in human lungs and body skins, while Aeromonas are major causes for gastroenteritis diseases, neurologic, respiratory, eye, and wound infections when one comes in contact with polluted water sources. Clinical researches has shown that low-grade fever, vomiting, diarrhoea and nausea are most frequently examined symptoms in humans. Hence, general health effect symptoms caused by coliform bacteria are gastrointestinal upsets, abdominal cramps, fever and diarrhoea this implies that the aforementioned stream water are not desirable for domestic used, and for safety application, it has to undergoes certain stages of locally as well as enhanced purifications processes in the forms of:

- Boiling the water and subsequently filtering through white cloths before further usage or the application of absolutely charged nanofiber filters;
- The application of shock chlorination to disinfects water;
- Reversed osmosis is equally important in removing bacterial, but it does not prove to be a total perfect process during cross-examination; and
- The application of Ozone purification or the application of Ultraviolet (UV) are more effective as it can destroys bacterial but can't remove bacteria from water source.

Table 5: Analysis of Organic Compounds and Trace Elements in some South-South Streams

Examination of Aromatic Concentrations			
Organic Petroleum Compounds (OPC)	**Specimen 1**	**Specimen 2**	**Specimen 3**
1, 2-Dichlorobenzene (1, 2-DCB) (μg/l)	903.50	731.45	893.59
1, 3-Dichlorobenzene (1, 3-DCB) (μg/l)	43.25	79.35	9.47
1,4-Dichlorobenzene (1, 4-DCB) (μg/l)	6.55	142.16	8.86
Benzene (μg/l)	63.50	29.56	32.25
Chlorobenzene (μg/l)	11.52	19.22	6,29
Ethylbenzene (μg/l)	305.55	112.54	126.77
M, p-xylene (μg/l)	21.22	9.21	23.14

xylene (µg/l)	4.97	91.79	506.55
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/l)	1.25	1.07	0.67
Styrene (µg/l)	23.25	21.55	18.25
Trichloroethene (µg/l)	70.75	75.25	72.25
Tetrachloroethene (µg/l)	42.55	54.05	32.86
Toluene (µg/l)	525.05	701.20	432.25
THC (methane equivalent) (mg/l)	586.07	635.25	289.75
Unresolved complex mixture (UCM)(mg/l)	113.25	106.14	103.55
Examination of Trace Elements (TE)			
Element	**Specimen 1**	**Specimen 2**	**Specimen 3**
Cadmium (mg/l)	0.019	0.014	0.006
Chromium (mg/l)	0.17	0.11	0.04
Copper (mg/l)	2.98	2.10	1.58
Iron (mg/l)	0.32	0.22	0.37
Lead (mg/l)	0.07	0.05	0.00
Manganese (mg/l)	0.53	0.44	0.51
Nickel (mg/l)	0.12	0.14	0.03
Zinc (mg/l)	3.97	3.31	0.00

***THC:** This describes the present amount of available hydrocarbon impurities, and are generally expressed as methane equivalents.
***UCM:** or refers to as Hump. This are features commonly experimentally seen in oils and extracts during gas chromatographic (GC) of crude results in relation to the exposure of organisms to oil. However, reasons for the appearance of UCM hump is because the GC can't analyze and identify a substantial hydrocarbons quantity present in oils.

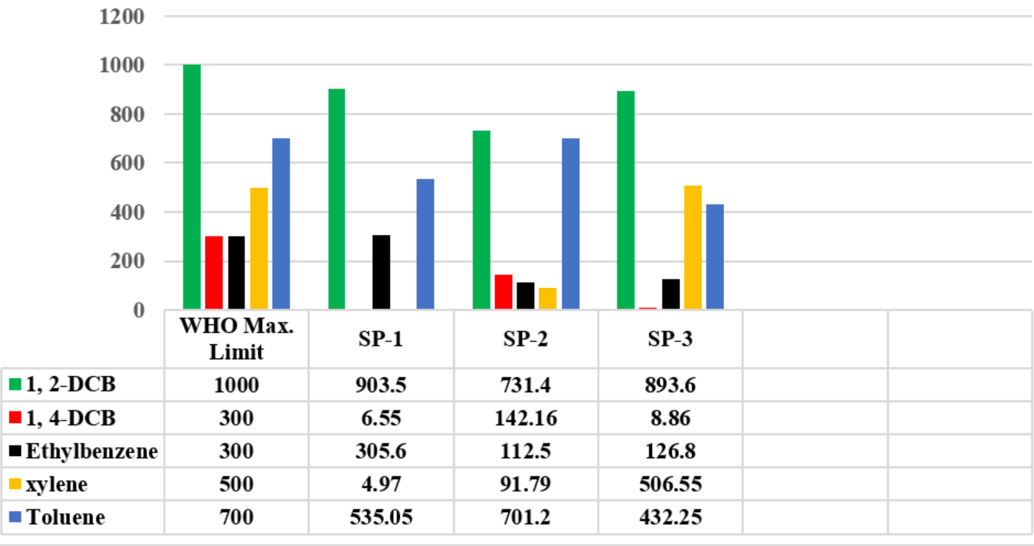


Fig. 6a): Organic Petroleum Compounds (OPC) in Streams Drinking Water South-South [Specimen (SP) 1, 2 & 3]

Specimen 1, 2 and 3 are similarly existing streams that are the major source of domestic water supply for three (3) major different communities that are from 3 different LGA from the South-South region in Nigeria. These communities like any other communities are surrounded by several other medium to small settlements within the same territorial landscapes, and are faced with serious water to social amenities problems, with virtually very limited and many distances to cover ranging from 7, 13 to 15 kilometers in order to source for manageable water for domestic utilization. These communities are not just faced with drinking water problems but, also faced with hydrocarbon polluted

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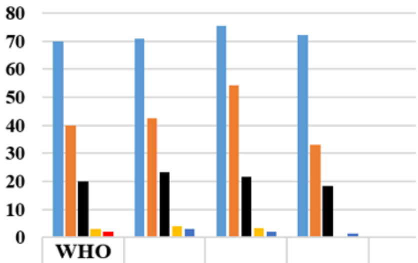
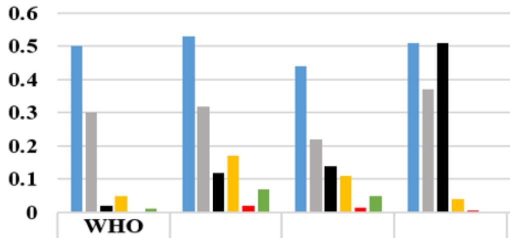
land mass problems, alongside ravaging poverty, with just very little and much not functional social facilities for utilization. Predominantly fishing and farming activities are their source of livelihood, now left with total polluted land and water that can't support both faming and fishing activities any longer, their present source of survival is total engagement in political thuggery, human kidnappings, pipeline vandalization and oil bunkering in the creeks. It can be said that some of the most essential sources of living in these communities are lacking on visit to these communities, these essential source of living are majorly soil and water, which is being evaluated herein table 5, figure 6a, 6b and 6c respectively.



	WHO Max. Limit	SP-1	SP-2	SP-3
Trichloroethene	70	70.8	75.3	72.3
Tetrachloroethene	40	42.6	54.1	32.9
Styrene	20	23.3	21.6	18.3
Zinc	3	3.97	3.31	0
Copper	2	2.98	2.1	1.58

Fig. 6b): Organic Petroleum Compounds (OPC) and Trace Elements (TE) in Streams Drinking Water South-South [Specimen (SP) 1, 2 & 3]



	WHO Max. Limit	SP-1	SP-2	SP-3
Manganese	0.5	0.53	0.44	0.51
Iron	0.3	0.32	0.22	0.37
Nickel	0.02	0.12	0.14	0.51
Chromium	0.05	0.17	0.11	0.04
Cadmium	0.003	0.019	0.014	0.006
Lead	0.01	0.07	0.05	0

Fig. 6C): Trace Elements (TE) in Streams Drinking Water South-South [Specimen (SP) 1, 2 & 3]

However, the laboratory examination results for organic compounds and trace elements (TE) found in both the drinking stream water source and in the soil samples within the communities can be deduced as follows; specimen 1, 2 and 3 level of organic compounds contamination as measured in concentrations exceeded the minimum allowable international standards limits, but in some case are close to the maximum allowable limits. The organic compounds that did not exceed these limits are; (1, 2-DCB µg/l), (1, 4-DCB µg/l), Ethylbenzene µg/l specimen 2 and 3, xylene µg/l specimen 1 and 2, Toluene µg/l specimen 1 and 3. Others includes; specimen 3 Tetrachloroethene µg/l and Styrene µg/l respectively. Hence, all other organic compound for these groups SP-1, SP-2 and SP-3 exceeded international standard limits of both WHO, ISO, USEPA, WSDE, USDHHS, KDHE and EUEPA. While 1, 3-DCB, THC and UCM has no international standard specification limits spelt by WHO, but their respective values for 1, 3-DCB are; 43.25 µg/l, 79.35 µg/l, and 9.47 µg/l, while for THC is 586.07 µg/l, 635.25 µg/l, and 289.75 µg/l so also for UCM are 113.25 µg/l, 106.14 µg/l, and 103.55 µg/l, respectively.

Furthermore, the trace elements (TE) concentrations that were within the allowable international limits are basically; Zinc 0.00 mg/l and copper 1.58 mg/l for specimen 3. Others includes iron 0.22 mg/l and Manganese 0.44 mg/l for specimen 2. While for specimen 3 are Chromium 0.44 mg/l and Lead 0.00 mg/l respectively. However, other parameters out of the fifteen (15) compounds that were evaluated and had exceeded the maximum allowable concentration as set by either of the major global international standards for hydrocarbon contaminated water and soils (WHO, ISO, USEPA, WSDE, USDHHS, KDHE, EUEPA, EGASPIN, NAFDAC, NOSDRA, NSDWQ etc.) are all inclusive entities of specimen 1, 2 and 3 respectively. Similarly, the laboratory results of available trace elements in these streams shows that stream 1 is heavily polluted when compared to that of stream 2 and 3, while also stream 2 is less polluted with trace elements when also compared to stream 3 in table 5 and figure 6b and 6c above. Generally both water in stream 1, 2 and 3 are not fit or suitable for domestic consumption, because of the eminent negative health implication such water has on humans. However, it's a fundamental human right for one to have accessibility to, if not portable, but safe drinking water, as element for effective government policies to protecting the health of its citizens. It's equally important to note that in most case there the effects are not immediate sign and or symptoms on the people living in these communities, this does not translates to lack of possible long-term negative implications, sometimes long-term exposures has been associated

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to heart and cancer diseases in humans or even sometimes leads to abnormal child births. It is the general duty of the central governments and the respective stakeholders to ensure effective compliance to BPEO in all ramification within the environment, because there could be no economy without people.

Table 6: Analysis of Total Petroleum Hydrocarbon (TPH) Content in Soil from 3 polluted Settlement

Examination of Total Petroleum Hydrocarbon (TPH)				
Hydrocarbon compounds	**Site A**			
	Soil Sample 1	**Soil Sample 2**	**Soil Sample 3**	**Mean Value**
Carbon preference index (CPI) (mg/Kg)	2.45	2.12	1.98	2.18
Total n-alkanes (TNA) (mg/Kg)	82.55	92.73	88.74	88.01
Total Petroleum Hydrocarbon (TPH) (mg/Kg)	292.50	301.85	298.12	297.49
Unresolved Complex Mixture (UCM) (mg/Kg)	176.50	182.55	179.25	179.43
	Site B			
Carbon preference index (CPI) (mg/Kg)	2.99	3.01	3.09	3.03
Total n-alkanes (TNA) (mg/Kg)	87.48	90.23	89.75	89.15
Total Petroleum Hydrocarbon (TPH) (mg/Kg)	294.55	298.78	299.01	297.45
Unresolved Complex Mixture (UCM) (mg/Kg)	178.45	181.50	180.02	179.99
	Site C			
Carbon preference index (CPI) (mg/Kg)	1.13	0.98	1.02	1.04
Total n-alkanes (TNA) (mg/Kg)	67.50	65.89	69.58	67.66
Total Petroleum Hydrocarbon (TPH) (mg/Kg)	225.05	219.99	240.10	228.38
Unresolved Complex Mixture (UCM) (mg/Kg)	162.47	159.69	171.53	164.56

Furthermore, table 6 is an analysis for the soil pollution extent caused by hydrocarbon concentration (THC) in the aforementioned communities from which water samples were collected. The average results of the 3 soil samples collected from these localities i.e. site A from town 1 and B from town 2 and similarly site C from town 3 are as follows; TPH in mg/Kg is 297.49, 297.45 and 228.38, while UCM average values are 164.56mg/Kg, 179.99 mg/Kg and 179.43 mg/Kg respectively. From this data and the other parameters as in the table above indicates that town 1 and 2 had approximately equal amount of pollutions in their soil, and even higher than when compared to that of town 3, these values and their variations are above the international permissible limits of contaminated soils having the presence of THC, UCM, TNA and CPI. This implies much is needed to fix the adverse effect of pollution caused by petroleum hydrocarbon spills, with no much effort made to addressing the situations, and this threatens the general survivals of both animals, plants, organisms and the ecological diversity of the locals. However, there are several efforts made to cleanup some of the contaminated soil of some affected communities, but physical assessment show virtually nothing has been done to salvage the polluted areas. Other supporting documentary evidences can be seen as according to [118] "there is delays and failures in tackling of oil spills in the Niger Delta", [119] "Bad information: oil spill investigations in the Niger Delta", [120]"Clean it up: Shell's false claims about oil spill response in the Niger Delta" and [121]"Negligence in the Niger Delta: decoding Shell and ENI's poor record on oil spills". Finally, it can be said that Nigerian environmental degradation are as a results of the following contributory human activities table 7 below.

Table 7: General summary of Major Sources of Environmental Degradation in Nigeria

Nigerian Regions	Major Source of Water and Soil pollution/contaminations
Northern Region	MSW disposal and dumping of wastes in water channels, and streams, Open defecation and dumping of sock-away excreta on farmlands, Chemical fertilizer, Herbicides and pesticides, Mining activities, Industrialization activities commercial, Auto-mechanic activities and spills,
Southern Region	Crude oil and Petrochemicals spills, Industrial chemicals discharge in the open environments and water bodies, Mining activities, Refuse dumps and dumping of refuse in gullies, water channels, streams and river, Open defecation in water bodies, Auto-mechanic activities and spills, Fishing with chemicals, Mining activities, Industrialization, and commercials, Petrochemical and hydrocarbon activities among others.
Western Region	Industrialization and commercial activities, MSW disposal and dumping of wastes in water channels, streams river gullies, Fishing with chemicals, Auto-mechanic activities and spills, Industrial chemicals discharge in the open environments and water bodies etc.
Eastern Region	Industrial mining activities, Industrial chemicals discharge in the open environments, and water bodies, Open defecation on land and water bodies, dumping of sock-away excreta in gullies, farmlands and in water bodies, Industrialization and commercial activities, Refuse dumps and dumping of refuse in water channels, streams and river as well as Auto-mechanic activities and spills, Petrochemical and hydrocarbon activities etc.

While others environmental problems in Nigeria includes:

- Loss of tree vegetation and biodiversity due to pollution and desertification activities;
- Visible global warnings and GHGs effects;
- Persistent water and soil pollution due to indiscriminant disposal of wastes and hydrocarbons spills in the environment;
- Pollutions due to industrial activities, fertilizers and pesticides as well as due to trace metals in soil and water;
- Pollutions of the available Coastal and Marine environment;
- Land degradation with major soil erosions;
- Scarcity and inadequacy of fresh drinking water in most rural and even urban communities.

RISK OF FLOODING:

Flooding has several negative implication when it happens, and among some of these major impacts are:

- A major cause for the damage of physical structures such as utility structures, bridge and culverts abutments, sewers and bank-lines, others can be severe damage to farmlands as well as endangering the lives and existence of biodiversity;
- During rainstorm and surface runoffs, the high velocity at which water flows, use to wash away the rigid parts of the soil blankets or crust (vegetable soils), which subsequently will results to soil erosion with associated sediments deposits elsewhere downstream the of directions fluid flow, living much destruction and pollution of breeding grounds for aquatics as well as wildlife habitations.

Engineering Flood Preventive Safety Managements:

There are numerous preventive strategies that can be employed in order to minimise the effects off over flooding within our communities and our physical structures, these includes:

- Constructing structural foundation wall beyond anticipated flood level and or constructing the building floor slab over a pier foundation and incorporate backflow valve which are manually operated in case of flooding, nevertheless it could be expensive, but most effective remediation measure for flooding;
- It's equally an effective option to improve most of the constructional materials to be waterproofing for constructions in flood prone areas;
- Drainage structures should always be kept clean and cleared from debris and sediments transported by rainstorm which apparently blocks drainage systems;
- There is the needs to construct both lakes, and earth or concrete dams with flood-control reservation meant to accommodate flood-water during rainstorm or summer melting seasons as well as levees, bunds, weirs to preventing the bursting of river banks. And similarly the use of

temporal perimeter barriers in case of the permanently built defence fails, an immediate emergency response is the use of sandbags;

- Similarly, it's important to have custom-built canals and or floodway which will subsequently diverts fluid precipitations to a provisionally holding ponds and or to any effective water body with minimal impact of flooding risks. Others may include; planting vegetation in order to hold excess water, as well as the need to terrace hilly areas so as to slow downhill fluid flow; and
- Finally the use of floodplains as well as underground water replenishment to serves as reservoir, where surplus water is diverted onto open field of lands with the ability to absorb water by seepage, which comically reduces later droughts negative impacts.

NIGERIAN OIL SPILLAGE CAUSES:

The major causes to current states of oil spillage are basically due to natural phenomena and human activities. The natural causes leading to oil spillage can be attributed to natural disasters and oil seepage in the ocean due to shifts in tectonic plates, which releases reserved crude oil confined deep after drilling underneath ocean floors. While oil spillage due to human activities are as a result of oil facility vandalization, damage, and oil siphoning due to production operations accident as well as due to bunkering activities.

OIL SPILLAGE EFFECTS ON IMMEDIATE COMMUNITIES:

There are several implications of oil spillage, some can be easily assessed immediately, while other can only be assessed on the longtime. Principally oil spillage is an agent of environmental contamination, however the major natural features that will be affected are the soil, water and biodiversity, and others are the host of these three elements. The spill of oil in the ocean can negatively affect both plants and animals at two boundaries. The first is close to the water surfaces, meeting point between water and air. While the second is along the shores, the meeting point between the land and water.

ENVIRONMENTAL RESOURCES CONTAMINATIONS:

WATER POLLUTION: When oil spills in to flowing water bodies, it spreads across the shores and flows downstream much quicker. While in stagnant water reservoir, the spilled oil remains within the environment for much longer durations, which subsequently will results to prolonged animal and plant exposures to different health problems and outbreak of diseases.

SOIL POLLUTION: Soil structure is highly affected by oil spills and vice-versa hinders the soil from proper aerations, because the presence of oil films on soil surfaces acts as physical barriers between the soil and air in respect to soil nutrient levels, temperature, soil pH value as well as the general analytical soil structures. Similarly several vegetation agricultures in such a contaminated soil will experience wilting and subsequently dies as a result of stomata blockage, which will hinders the respiration process of plants, transpiration and photosynthesis.

HUMAN HEALTH EFFECTS: Oil spillage can affect human health majorly by breathing polluted air as well as consuming toxic metals through water and vegetation intakes. It's equally important to note that oil contains certain amount of chromium (Cr), and coming in contact with certain Cr compound may lead to skin ulcer, liver damage, kidney problem and sometimes death related issues. Similarly, water contaminated by oil spill containing smaller amount of Barium (Ba) soluble in water may lead to human experiencing either of, or multiples of;

- Serious respiratory difficulties and change in heart rhythm
- Heart damage, Kidney and liver problems;
- Swollen brain effect and skin ulcer problems;
- Increasing blood pressure in humans;
- Stomach irritations and vomiting; and
- Change associated with nerve reflexes and flawed muscle.

V. CONCLUSION

It's however eminent that flooding is a major and serious disaster which affects virtually all parts of Nigeria each year. Flood in Nigeria does not damage just only assets and endangers the existence of biodiversity, but a major cause for disease outbreaks in the likeness of water borne diseases. Oil spillage is another nightmare that affects majorly the south-Southern region of Nigeria, destroying the mangrove rich forest, living its host communities vulnerable to several health issues, with many of whom had no access to clean water, food and farmlands to grow agricultural vegetation due to oil spills. Water contamination due to the presence of wastes and oil spills has severe long-lasting negative health implications on humans. However, this was one of what prompted this research work, with the view to examine the EH&S of the rural dwellers and the negative human impact as well as the extent of contamination caused by human activities within the immediate environmental resources (soil and water) of the North-Central and the South-South regions.. Hence, samples of both water and soils were collected from several location so as to determine the major physiochemical, bacteriological parameters, as well as THC, UCM, CPI among other TPH compounds. Hence, the results indicates a higher degrees of contaminations which are detrimental to the existence of both plants and animals alike as detailed in table 4, 5, 6 and figure 5a, b, c and d as well as figure 6a, 6b and 6c respectively.

RECOMMENDATION

- Government should take efficient and effective steps towards ensuring prudent geographical mappings, monitoring and due maintenances of the available and future existing floodplains, natural and artificial water reservoirs and dams, as well as sea coast;
- This research is recommending proactive governmental and nongovernmental participations towards the provision of affordable portable drinking water in the form of industrialised sunked boreholes in both urban and rural settlements;
- Governments should invest more resources into water research and technologies to come up with modular water treatments facilities in major settlements for the provision of portable drinking water so as to minimise or eliminate the presence of harmful microorganism in drinking water; also
- Government should enforce newer methods in measuring TPH soil, such as rapid total petroleum hydrocarbon contents (TPH) testing kits to include the use of "Non-destructive infrared method" these will allow for quick and easier analysis of TPH for the possibility of remediation associated activities. Because there is little or no much time to waste during decision implementation relating to site soils delimitation as well as excavations and in order to determine the completion time of soil remediation. It's important and much necessary to always conduct TPH test as monitoring tool for establishing clean-up standards for both soils and surface or underground water tables.

Other Recommendations Relating to Nigerian Oil Spillage and Environmental Contaminations Mitigation Measures are as follows:

Mitigating the lingering oil spillage problem vice-versa environmental degradations menace in Nigeria requires utmost government commitment to BPEO with prudent enforcement of stringent government policies and plans backed by effective implementations as well as monitoring process. Therefore, government should institutionalize mandatory environmental awareness and management at all levels of education and teaching curriculums. Government policies should make it mandatory to fund in collaboration with oil corporations, with due consideration to Environmental Impact Assessments (EIA) recommendations to develop communities in which natural resources are located for economic productivities, as well as to pay compensation for any form of issue or damage caused by any form of exploration activities. Similarly, other effective ways of solving environmental contamination in Nigeria will include active government participation in collaboration with oil companies to provide host communities with basic social amenities as well as insuring total free medical care and treatments for contamination related health issues. Likewise the governments, oil companies and the host communities should agree on certain memorandum to form well equipped rapid tactical respond squad in order to tackle oil spills, vandalization and bunkering activities, as well as to create a special court to arranged oil, mining and contamination related cases on time with stringent penalties

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NOMENCLATURE

Acronym	Descriptions	Acronym	Descriptions
API	American Petroleum Institute	GHGs	Green House Gasses
APHA	American Public Health Association	KDHE	Kansas Department of Health and Environment
ASTM	American Society for Testing and Materials	LGAs	Local Government Areas
BPEO	Best Practice Environmental Options	MWS	Municipal Solid Waste
CCME	Canadian Council of Ministers of the Environment	NAFDAC	National Agency for Food and Drug Administration and Control
CER	Certified Emission Reduction	NEMA	National Emergency Management Agency
DPR	Department of Petroleum Resources	NOSDRA	National Oil Spill, Detection and Response Agency
EGASPIN	Environmental Guidelines and Standards for the Petroleum Industry in Nigeria	NSDWQ	Nigeria standard for drinking water quality
EH&S	Environmental Health and Safety	SEMA	State Emergency Management Agency
ERP	Emission Reduction Project	USDHHS	United States Department of Health and Human Services
EUEPA	European Union Environmental Protection Agency	USEPA	United States Environmental Protection Agency
FCT	Federal Capital territory	WHO	World Health Organization
FMENV	Federal Ministry of Environment	WSDE	Washington State Department of Ecology

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