

Lack of Proper Safety Management Systems in Nigeria Oil and Gas Pipelines

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Implementing safety management systems (SMS) can be a difficult task when the oil and gas companies operate in an environment with several human, cultural, technical and operational constraints that impact negatively on safe operations. This is also coupled with high demands for transparency, compliance with laws and legislations as well as international standards to maintain safe operations of pipelines. Companies are also expected to adequately analyse the possible hazards of their operations and effectively manage their risks. They are expected to perform accident-free operations with environmentally friendly responsibilities, improve the efficiency of their pipelines with proper integrity management systems, improve emergency response systems, and most importantly learn lessons and apply corrective measures from past incidents. This paper aims to analyse pipeline related incidents in Nigeria to identify the underlying causes of these recurring accidents with reference to the widely accepted principles of safety management systems.

Keywords: Safety Management Systems, Petroleum Pipeline, Nigeria

Introduction

The recurrence of fatal pipeline incidents in Nigeria have gained a global attention as a result of loss of life, water pollution, soil contamination, air pollution, destruction of the ecosystem (flora and fauna), destruction of property and infrastructures, and loss of crude oil and refined products. The lack of robust safety management systems is one of the major reasons behind the high rate of recurring pipeline incidents which constitute a serious threat to the petroleum industry and the Nigerian economy. Pipeline ruptures and vandalism are the most common incidents that cause oil spillages, fires and explosions in Nigeria. Corrosion, lack of regular inspection, lack of proper maintenance, operational failures and natural disasters are among the contributory factors to pipeline ruptures.

Pipeline vandalism through the deliberate use of explosives or machines to cut or drill pipelines is motivated by greed for personal gain, scarcity of petroleum products, protest against neglect from government, and protest against environmental degradation resulting from oil companies' activities.

Oil companies need to carry out proper hazard identification of the operation they perform whether these are man-made or natural, and manage their risks using appropriate technology in order to ensure safe working practices, the safety of their personnel and the protection of the public and the environment.

Table 1 shows some of the examples of the pipeline incidents in Nigeria which were reported in different media, from the period 1998 to 2013.

Table 1: Some cases of pipeline vandalism/rupture associated with fire explosion, deaths, destruction of farmlands and businesses with environmental pollution from 1998 to 2013.

DATE & LOCATION	CONSEQUENCES
17 th October, 1998. Jesse in Delta State, Nigeria.	More than 1000 deaths, dozens injured, damaged farmland and environmental pollution (Onuoha, 2007)
22 nd April, 1999. Bayana in Delta State, Nigeria.	At least 10 deaths, damaged farmland, air and water pollution (Onuoha, 2007)
8 th June, 1999. Akute Odo in Ogun State, Nigeria.	At least 15 deaths, damaged farmlands, land and air pollution (Onuoha, 2007)
13 th October, 1999. Ekakpamre Ughelli in Delta State, Nigeria	Undetermined deaths, damaged farmlands, and environmental pollution (Onuoha, 2007)
14 th January, 2000. Gana community in Delta State, Nigeria.	At least 12 deaths, damaged farmlands, and environmental pollution (Onuoha, 2007)
7 th February, 2000. Ogwe in Abia State, Nigeria.	At least 15 deaths, damaged farmlands and environmental pollution (Onuoha, 2007)
20 th February, 2000. Lagos State, Nigeria.	At least 3 deaths, damaged farmlands, canoe, and environmental pollution (Onuoha, 2007)
14 th March, 2000. Umugbede Osisioma in Abia State, Nigeria.	At least 50 deaths, damaged farmlands and environmental pollution (Onuoha, 2007)
4 th April, 2000. Uzo-Uwani in Enugu State, Nigeria.	At least 6 deaths, damaged farmlands and environmental pollution (Onuoha, 2007)
3 rd June, 2000. Adeje in Delta State, Nigeria.	Undetermined deaths, forest damaged, destruction of high-tension power cable of two electricity plants, and police/youth clash (Onuoha, 2007)
20 th June, 2000. Ekuedjeba Warri in Delta	Undetermined deaths, damaged farmlands and environmental pollution

State, Nigeria.	(Onuoha, 2007)
10 th July, 2000. Adeje/Egborode Okpe in Delta State, Nigeria.	At least 150 deaths, damaged farmlands and environmental pollution (Onuoha, 2007)
10 th July, 2000. Oviru Court in Delta State, Nigeria.	At least 300 deaths, dozens injured, damaged farmlands and environmental pollution (Onuoha, 2007)
23 rd July, 2000. Afrokpe Sapele in Delta State, Nigeria.	At least 40 deaths, and environmental pollution (USATODAY, 2006)
24 th July, 2000. Afrokpe Sapele in Delta State, Nigeria.	At least 15 deaths and environmental pollution (USATODAY, 2006)
30 th November, 2000. Port of Lagos, Nigeria	About 60 deaths, and environmental pollution (USATODAY, 2006)
5 th November, 2001. Umudike in Imo State, Nigeria.	3 deaths, 17 injured, and environmental pollution (Onuoha, 2007)
29 th September, 2002. Akute-Odo in Ogun State.	Undetermined deaths and injured, and environmental pollution (USATODAY, 2006)
19 th June, 2003. Onitcha Amiyi – Uhu Ovim in Abia State, Nigeria.	125 deaths, dozens injured, damaged farmland and environmental pollution (Onuoha, 2007)
6 th January, 2004. Elikpokwodu in Rivers State, Nigeria	Undetermined deaths, destroyed properties and 200 hectares of farmland, and environmental pollution (Onuoha, 2007)
30 th July, 2004. Aghani in Enugu State, Nigeria.	At least 7 deaths, several injured, and environmental pollution (Onuoha, 2007)
16 th September, 2004. Ijegun in Lagos State, Nigeria.	At least 60 deaths, air and water pollution (Onuoha, 2007)
December 2004. Imore in Lagos State, Nigeria.	At least 500 deaths and environmental pollution (Onuoha, 2007)
30 th May, 2005. Akinfo in Oyo State, Nigeria.	16 deaths, several injured, and environmental pollution (Onuoha, 2007)
13 th January, 2006. Iyeke in Edo State, Nigeria.	7 deaths, 6 injured, damaged farmlands and environmental pollution (Onuoha, 2007)
12 th May, 2006. Ilado in Lagos State, Nigeria.	150 deaths, several injured, water and environmental pollution (Onuoha, 2007)
2 nd December, 2006. Ijeododo in Lagos State, Nigeria.	1 death, damaged farmland and environmental pollution (Onuoha, 2007)
26 th December, 2006. Abule Egba in Lagos State, Nigeria.	At least 500 deaths, burnt 40 vehicles, destroyed dozens of home including a mosque and two churches, and innumerable business ventures (Onuoha, 2007)
16 th May, 2008. Ijebu in Lagos State, Nigeria.	At least 100 deaths, and environmental pollution bulldozer struck an oil pipeline (Seattletimes, 2008)
1 st October, 2012. Osisioma in Abia State, Nigeria.	At least 15 deaths, 20 injuries and environmental pollution (Ogbeni, 2012)
17 th December, 2012. Ododo Community in Ojo, Lagos State, Nigeria.	Undetermined death and environmental pollution. (Agha, 2012)
13 th January 2013. Arepo in Ogun State, Nigeria	At least 30 deaths and environmental pollution (Olatunde and Akinkuotu, 2013)
6 th October, 2013. Okwokolo community, Mereje, Okpe in Delta State, Nigeria.	2 deaths, 8 injured and environmental pollution. (Amaize and Ahon, 2013)
6 th October, 2013. Tariya village of Bassa, in Plateau State, Nigeria.	4 deaths and environmental pollution. (Nanlong, 2013)

Features of a Safety Management System

According to Elke (2007):

“Regardless of the terminology, a safety management system or a process safety management or a process hazard management, these are all systems that have been developed to manage the risk to personnel, property, production, the environment and ultimately, the company reputation”

Safety management systems holistically deal with the organization’s safety activities, policies, responsibilities, practices, procedures, and resources to prevent accidents and ensure that risk is reduced as low as is reasonably practicable, which is normally carried out through Plan-Do-Check-Act business management system, and according to HSE (2013) “A safety management system is a crucial mechanism in the delivery of safety”

Bayuk (2008) explained SMS as a part of business operation through which an organisation proactively manages safety that concentrates on controlling business processes, starting from the policy, organisation structure, organisation safety culture, training, communication, hazard identification, risk management, emergency response and incident investigation. It is a management approach through which a safety policy is established with objectives, set out a plan to achieve these objectives, work towards the objectives and continuously checking the outcomes against the plans, and most importantly, take appropriate corrective actions as a result of lessons learned from past experience.

There are different opinions on the essential components of SMS but the special aim of these different components are identification of hazard, proper management of risk, maintain organisation's safety performance, apply lessons learned from past incidents, continuous monitoring and assessment of safety performance, and continuous improvement of overall performance of the SMS (Thomas, 2011).

Mitchison and Porter (1998) set out seven fundamental and important elements that should be addressed by safety management system.

Table 2: *Elements of Safety Management System (Mitchison and Porter, 1998)*

ELEMENTS OF SMS	PURPOSE
Organisation and personnel	The roles and responsibilities of personnel involved in the management of major hazards at all levels in the organisation safety culture. The involvement of employees and subcontractors in the safety policy and its implementation.
Identification and evaluation of major hazards	Develop and implement procedures to systematically identify and evaluate hazards arising from all the stages of its activities.
Operational Control	Prepare, keep up to date, and implement procedures for safe operation, including maintenance of plant, processes, equipment and temporary stoppages.
Management of Change	Adopt and implement management procedures for planning and controlling all changes in people, plant, processes and process variables, materials, equipment, procedures, software, design or external circumstances which are capable of affecting the control of major accident hazards
Planning for Emergencies	Develop, adopt, and implementation of procedures to identify foreseeable emergencies by systematic analysis and to prepare, test, revise, updated and review emergency plans to respond to such emergencies.
Monitoring Performance	Maintain procedures to ensure that safety performance can be monitored and compared with the safety objectives. Active monitoring by inspections and assessment of compliance with training, instructions and safe working practices. Reactive monitoring by effective incident/accident report and investigation system.
Audit and Review	Audit to ensure that the organisation, processes, and procedures as defined and as actually carried out are consistent with the Safety Management System. Review to ensure the SMS appropriately fulfil the operator's policy and objectives, and if necessary modify the policy and objectives the SMS.

Safety management systems are very important in oil and gas industries because they help to improve the organisation's safety, reduce accidents, reduce deaths and injuries, reduce lost time and other materials and product losses.

Bayuk (2008:3) in the presentation of using SMS as a template for aligning safety with business strategy in other industries outlined the benefits of SMS as follows:

- Reduction of the direct and indirect costs of accidents - Fines, repair costs, damage claims, and increased insurance premiums.
- Improved employee morale and productivity - Promoting communication between management and the rest of the organization prevents disenfranchisement and lifts morale.
- Establishing a marketable safety record - A record of consistently safe operations can be used to attract new business and investment.
- Logical prioritization of safety needs - SMS emphasizes risk mitigation actions that provide the biggest impact on both safety and the bottom line.
- Compliance with legal responsibilities for safety and other standards that can be included in an organization's SMS.
- More efficient maintenance scheduling and resource utilization - Effective hazard reporting in SMS allows proactive scheduling of maintenance tasks when resources are available, increasing the likelihood that maintenance is performed on time and more efficiently.
- Avoiding incident investigation costs and operational disruptions - Improved communication and risk mitigation will prevent many accidents from ever occurring.
- Continuous improvement of operational processes - SMS allows for lessons learned to be incorporated into the system and lead to superior operations.

Analysis of Nigeria Pipeline Accidents

Table 3 shows the reported accidents on the pipelines owned by Nigeria National Petroleum Corporation (NNPC) and operated by its subsidiary Products and Pipelines Marketing Company (PPMC). NNPC has the largest pipeline network in Nigeria which runs almost throughout the country with about 5120 km of pipelines. Most vandalism and rupture are reported in these pipelines because it runs crude oil and refined products.

Table 3: (NNPC, 2013) Pipeline Incidence on NNPC pipeline for the past 14 years (1999 - 2012). (Source: NNPC statistics bulletin from 1999 to 2012, and confirmation of data from the office of NNPC)

Year	Vandalism	Rupture	Fire outbreak
1999	497	27	No record
2000	984	137	46
2001	461	26	46
2002	516	26	39
2003	779	48	44
2004	895	76	45
2005	2,237	21	117
2006	3,674	9	39
2007	3,224	20	18
2008	2,285	33	25
2009	1,453	27	4
2010	836	24	0
2011	2,768	19	25
2012	2,230	26	34
TOTAL	22,839	519	482

Analysis of the data available and open literature on some of these accidents shows that the incidences are direct results of systematic failure in properly instituting and implementing effective safety management systems. The analysis is carried out against several of the subheadings that are expected to be included in an overreaching safety management system.

Lack of proper incident reporting:

One of the major problems in the Nigerian petroleum industry is the lack of proper information about incidents. Incidents do happen but the management of concerned companies would deliberately withhold information about the incidents and this makes it difficult to analyse and understand the root causes of the respective accidents. Also several companies tend to alter information and data that relates to accidents. They do this in order to avoid legal penalties, paying compensation to affected victims, paying for damages, incur repair costs, and avoid being held responsible for environmental clean-up. This problem has become part of the prevalent dysfunctional safety culture in the Nigerian petroleum industry and it makes solving the problems more complex and difficult.

Inadequate hazard identification and risk assessment:

According to Taylor (1994):

“Pipeline risk is different from other plant risk because the risk is associated with a line source rather than a series of point sources of risk”.

Oil companies need to carryout proper hazard identification on their pipeline systems irrespective of whether these hazards are man-made or natural and they must manage their risks using appropriate technologies.

Steiner (2010) in his comparative studies of the Nigerian oil industry with its US counterpart maintained that the Nigeria oil companies need more hazard analysis and risk assessment because most parts of Nigeria meet the criteria defined in the U.S. as High Consequence Areas for oil spills (populated area, drinking water area, or productive ecosystem). Oil companies in Nigeria are implicitly required by Nigerian law to comply with international standards like the API standards for High Consequence Areas and therefore require more hazard analysis and risk assessment”.

Lack of comprehensive pipeline integrity management system:

A pipeline integrity management system comprises safe operation, proper inspection and preventive and predictive maintenance. This involves monitoring and inspection of the pipeline during operations in order to detect pipeline leaks, possible hazards and also to determine locations where a failure would have high consequences. This must be followed by necessary measures to ensure that repairs/maintenance and modifications are implemented. This must be accompanied by proper emergency management and corporate communication with the public in case of danger.

Steiner (2010) revealed that some Nigeria oil companies do not disclose information about their pipeline integrity management.

Most pipelines in Nigeria are more than 20 years old making them vulnerable to corrosion and leakage. Some of these pipelines networks date back to the 1970s, and the majority of the pipelines designs have a limited lifespan of 20 years or less though many of the pipelines still remain operational to date. Some of the pipelines were not properly laid down below the surface and can easily be exposed with little or no erosion. Some of the costal pipelines are now exposed to the elements due to erosion. Other pipelines were originally laid above ground level further necessitating replacement. Most of these pipelines have been subjected to deterioration due to aging, aggressive environmental factors, inadequate design and improper protection and maintenance (Ogwu 2011; Shahriar et al, 2012; Anifowose et al, 2012; Pipeline International, 2010).

Confusion between occupational health and process safety:

The confusion between occupational safety and process safety has resulted in concentration on occupational health over process and operational safety.

Occupational health is commonly mistaken for process safety and used to supplant the requirements of process safety leading to lack of proper risk identification and absence of mitigating measures.

Lack of compliance with legislations and international standards:

Legislations and internationally accepted guidelines are in existence and actually referenced in the different acts governing the oil industry in Nigeria but lack of compliance with these guidelines is a major factor in the poor safety performance of the oil industry. Steiner (2010) in his comparative studies of the Nigerian oil industry with its US counterpart maintained that Nigeria oil companies need to comply with accepted international standards such as the API standard for pipeline integrity, leaks, etc. According to Steiner (2010):

“In order to prevent oil spills, Nigerian law requires oil companies to ensure ‘good oil field practice’ by complying with internationally recognised American Petroleum Institute (API) standards for all petroleum production and transportation operations”.

“As most parts of the Nigeria meet the criteria defined in the U.S. as area susceptible to damage from third parties (vandalization and illegal bunkering), and the American Petroleum Institute (API) has developed guidelines to protect operators from the risk of terror attacks and vandalism. To be in compliance with Nigerian law requiring international standards, oil companies in Nigeria must meet this standard”.

Lack of enforcement & monitoring systems:

It is as good as not having a legal framework where there is no effective enforcement and monitoring system. Effective monitoring and enforcement by a regulator is very crucial to the efficacy of any regulatory system, and this is facilitated by sufficiently robust laws that are comprehensive and consistent with a range of sanctions to help compel compliance and maintain effective enforcement (Ogbodo, 2009).

The Department of Petroleum Resources (DPR) in the Federal Ministry of Petroleum exercises the statutory supervision and control of the oil and gas industry including the pipeline sector with legislations and guidelines on the operation and maintenance of the pipeline but there is a very weak enforcement and monitoring system. From the Nigeria Oil Pipelines Acts and Oil & Gas Pipelines Regulations it was observed that:

- Regulatory framework did not prescribe adequate enforcement and monitoring system for vandalism or sabotage.
- Regulatory framework did not prescribe adequate enforcement and monitoring system for pipeline maintenance programme
- Regulatory framework did not prescribe adequate technologies, guidelines, or enforcement and monitoring system for pipeline integrity management
- Regulatory framework did not prescribe guidelines on how to implement, maintain, enforce and monitor an effective security systems for the pipelines
- Regulatory framework did not prescribe guidelines, enforcement and monitoring system on how the public and stakeholders can adequately be educated on the dangers associated with tampering with pipeline systems

The recent 2012 Nigeria Petroleum Bill proposed to establish two monitoring regulatory agencies and their duties are shown in the table 4.

Table 4: Proposed Regulatory Monitoring Agencies (The Nigeria Petroleum Industry Bill, 2012)

NAME	PURPOSE
Upstream Petroleum Inspectorate	To administer and enforce policies, laws and regulations relating to all aspects of upstream petroleum operations and issue and administer licenses and leases in the upstream sector.

Downstream Petroleum Regulatory Agency	To administer and enforce policies, laws and regulations relating to all aspects of downstream petroleum operations and issue and administer licenses and leases in the downstream sector.
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These regulatory enforcement and monitoring agencies are not in place and this shows that the Nigerian petroleum industry have been operating with little or no enforcement and monitoring system.

Incident investigation and intervention:

The causes of the most deadly oil and gas incident in Nigeria, the Jesse pipeline explosion which happened on 17th October 1998 are still a mystery to date. This is indicative of the lack of proper incidents investigation. This is also the same case with other pipeline incidents in Nigeria because oil companies tend to assume that the causes of pipelines incidents are vandalism thus absolving them from responsibilities and liabilities for the said incidents.

The main aim of incident investigation is to find out the root cause, analyse it, learn some lessons and make sure such incident never happens in future. A good incident investigation with proper lessons learned helps to improve the safety system, workers job roles, address the employers and employees shortcomings, prevent future occurrence of such incident, help to reduce the impact if such incident occurs, and thereby improve the business of the organisation (CCPS, 2007).

According to CCPS (2007):

“Incident investigation is a process of reporting, tracking, and investigating incidents that includes (1) a formal process for investigating incidents, including staffing, performing, documenting, and tracking investigations of process safety incidents and (2) the trending of incident and incident investigation data to identify recurring incidents. Incident investigation should not be used to assign blame or point accuse finger for the cause of an incident. It should be used as a process to develop effective recommendations to address the underlying system-related causes of incident”.

Questionable Operating Practices:

Most oil and gas pipelines are run using computer-based workstations in remote locations to detect leaks and to monitor and control the pipelines. Most pipelines in Nigeria lack modern equipment which makes it difficult to effectively detect leaks that may have been caused by rupture or vandalism in a timely manner. The standard pipeline operating procedures and practices supposed to include alarm management, Leak Detection Systems (LDS), and Supervisory Control & Data Acquisition (SCADA), which help to detect leaks and vandalized pipelines.

Lack of proper emergency management:

There have been several reports of pipeline leaks but due to lack of emergency management procedures several of these leaks developed into fires and explosions. A safety management system is incomplete without a comprehensive emergency management system. Emergency management systems help the petroleum industry articulate response plans clearly outlining procedures to follow, improve their safety management system, safeguard their assets, minimise injury and loss, and provide proper communications to the public and stakeholders in case of accidents.

Lack of leadership commitment:

The recurrence of pipeline incidents shows complete lack of proper leadership commitment towards the future safety of people and prevention of accident. This applies to the government as well as company management. When the management fails to learn from past incidents and ignores the safe operation of their assets there will be a poor organisational safety management system. Bayuk (2008) explained that leadership commitment to safety does not only involve establishing policy, providing direction and targets, but also requires a strong focus on safety through communication, commitment, participation, providing resources, and taking responsibilities for addressing safety issues. The lack of a properly designed and implemented legal framework that imposes serious sanction on company management is not helping to focus attention on the role of managers and the need for their total commitment to safety and loss prevention.

Lack of Proper Management of Third Party Interference:

Settlement and urbanisation have knowingly or unknowingly intruded into the pipeline Right Of Way (ROW) thereby exposing people to pipeline hazards. Houses and businesses are built too close to pipelines and in the Jesse pipeline explosion on 17th October 1998 two villages were completely destroyed with more than 1000 inhabitants burned to death.

This was a direct result of poor management of third party interference. There was lack of proper monitoring and surveillance of population movement and utilisation of land, poor pipeline markers, poor deterrence of third party infringements, and poor land use planning & management.

Poverty and lack of education of people/stakeholders:

According to the BBC (2012) Nigeria is a country where 61% of the population or almost 100 million people live on less than a \$1 (£0.63) a day with people doing everything they can in order to survive. Poverty is one of the main reasons why people gather at leaking pipeline sites in order to scoop fuel and sell it in the black market. Building businesses or houses

and farming on lands close to the pipelines are acts of survival given the levels of poverty and desperation. Nigeria government and the petroleum industry need to educate people on the dangers of petroleum and its products.

Corruption and the blame culture:

Safety is an integral part of any process operation and it goes hand in hand with honest reporting, transparency, accountability and consistency.

Safety management systems cannot thrive in a corrupt and blame oriented organisational culture. Improper manipulation of safety related information and investigations are a form of corruption and could mount to criminal behaviour.

Some abnormal activities associated with safety management in Nigeria are perceived as normal behaviour. Marenin and Resig (1995) revealed that “crime is committed within specific contexts and some crimes are seen as ‘normal crime’ in Nigeria”.

Rupture of pipelines is one of the causes of pipeline incidents and the oil and gas industry as well as the Nigerian government are always quick to blame the citizens for vandalizing pipelines without carrying out proper investigations. Amnesty international (2013) on their investigation on oil spillage in Nigeria confirmed that “oil companies often blame oil spills on vandalism in order to get out of paying compensation when in fact corroded pipes are the cause”.

Another problem is the institutional corruption at all levels of authority and the widespread of bribery and the culture of impunity.

The blame culture has led to lack of proper reporting, hesitancy to admit errors and correct them and frequent attempts to cover up mistakes. These led to lack of commitment to proper safety practices on part of both employees and management which made it very difficult to properly analyse incidents in order to find the root causes and prevent their repetition in the future.

Not learning from past incidents:

One of the surest ways to improve a safety management system is by learning from past incidents. An estimation of over 3000 people has lost their lives through pipeline incidents in Nigeria with alarming similarities of the accidents which indicate that no lessons have been learned from these tragedies. Moreover, there were no proper documentations of past accidents which made learning from past incident a difficult task.

From Table 3, a total of 23,840 incidents were reported on NNPC pipelines in the last 14 years, from 1999 to 2012. A total of 22,839 of which alleged vandalism represent 95.8% of the total incidents and ruptures represent 2.2%. Although the data given treats fires outbreak separately, in reality some of these fires resulted from the ignition of the liquid or gas released as results of vandalism or rupture.

Figure 3: Graphical representation of Vandalism, Rupture and Fire Outbreak in NNPC pipeline (1999-2012)

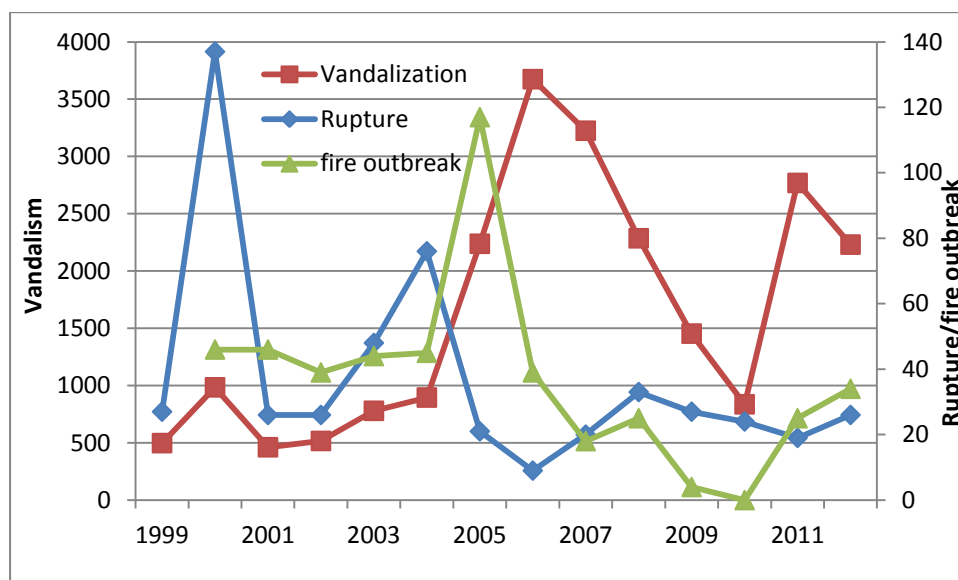


Figure 3 show that there was increase in both ruptures and vandalism from the year 1999 to 2004. This was followed by a remarked increase in incidents reported as vandalism while number of ruptures remained almost constant.

Due to the lack of proper incident investigation it is not possible to confirm the validity of these sets of data. The high increase in the cases of vandalism from 2005 to 2012 could be the result of grievances caused by neglect from government, scarcity of petroleum products, lack of compensation from environmental damage and protest against environmental degradation resulting from oil companies' activities.

But more troubling is the possibility that the data may have been altered to classify some of the pipeline rupture incidents as vandalism to avoid responsibility by both the authorities and the companies. Several tracts of the pipelines are too old and were not constructed to modern standards making them vulnerable to corrosion and leakage. Lack of proper maintenance and regular inspections also increase the probability of ruptures.

Also the data shows that fire outbreaks decreased since 2005 which could be due to more organised and sophisticated intrusion efforts by organised criminals (Onuoha, 2007; Igwe, 2007; Reuters, 2013).

The high record of incidents shows lessons are not been learned from past incidents.

Conclusion

The Nigerian oil industry managed to develop a dubious reputation due to the recurring safety incidents that resulted in both material and human loss.

Analysis of data available and published literature indicated the repetition of the same events and consequences in many incidents indicating the failure to learn from past mistakes.

The analysis showed a deeper malaise as the repeated incidents are indicative of a lack of properly instituted and implemented safety management systems in the pipelines sector of the Nigerian oil industry.

Oil companies in Nigeria need to comply with internationally accepted standards such as the API international standards. Standards relevant to pipeline integrity and management, especially the API standards for High Consequence Areas which requires more hazard analysis and risk assessment, and API guideline standards for Area Susceptible to damage from third parties (vandalism, terror attack, illegal bunkering, theft, etc.) are prime examples of standards to follow in order to improve safety and environmental standards.

The human, cultural and operational factors that affect effective safety management system in the Nigeria pipeline industries should be approached in the right way with the help of Nigerian government because it would be a waste of resources if not done in an organised and effective way. The Nigerian government needs to explicitly tackle these threats by implementing corrective procedures and measure performance against clearly identifiable standards.

More important is the proper introduction and implementation of a comprehensive regulatory framework with effective enforcement and monitoring systems that can help to maintain proper safety management systems which are vital for the future of the Nigerian industry as a whole and the oil and gas industries in particular.

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Abbreviations

API	American Petroleum Institute
BBC	British Broadcasting Corporation
CCPS	Center for Chemical Process Safety
DPR	Department for Petroleum Resources
HSE	Health and Safety Executive

LDS	Leak Detection Systems
NNPC	Nigerian National Petroleum Corporation
PPMC	Pipeline Product Marketing Company
ROW	Right Of Way
SCADA	Supervisory Control & Data Acquisition
SMS	Safety Management System