Oil & Gas Research
ISSN: 2472-0518

Paul and Archana, Oil Gas Res 2018, 4:3
DOI: 10.4172/2472-0518.1000157

Review Article Open Access

System Engineering Design of Offshore Oil Drilling Production Platform from Marine Environment

Paul CN* and Archana SN

Department of Environmental Technology, School of Engineering and Engineering Technology, Federal University of Technology Owerri, Nigeria

Abstract

This paper deals with systems engineering applications design for offshore oil drilling production platform in the Nigerian Marine Environment. Engineering Design model of the distribution and accumulation of petroleum hydrocarbons discharged into marine environment production platform and sources of impact of an offshore is treated.

Keywords: Design offshore; Oil drilling production; Platform marine environment

Introduction

The study deals with the design and fabrication of oil drilling and production platform engineering and environmental impact assessment in the context of Nigeria oil petroleum processing. The physico-chemical parameters in addition with biological indicators of pollution are used for ascertaining existing status of water columns and sediments giving rise to marine environment reducing bacteria and total heterotrophic bacteria. Regulated waste discharge from drilling platforms and oil terminal result in moderately high residues in localized areas. Further investigations ascertained the pathway through which pollutants entrain the body of zooplankton and their consequences on higher trophic level of food chain. The zooplankton may accumulate pollutants in either of the three ways:

- Phytoplankton diets,
- Assimilation of particulate diets or
- By direct uptake from sea water.

Fishes absorb hydrocarbons from water. The rate of uptake from sea water directly depends upon exposure period and lipid content of the fishes. Fishes and other aquatic organisms usually aggregate in and around natural and artificial structures including petroleum platforms in marine environment. The distribution, into the accumulation of petroleum hydrocarbons discharged into marine environment.

The phytoplanktons are capable of biosynthesizing hydrocarbons, which in turn contribute to hydrocarbons in fishes. Marine fishes accumulate a wide variety of petroleum hydrocarbons in their tissues. Aromatic hydrocarbons are accumulated to greater extent and are retained longer than aliphatic hydrocarbons. The accumulation of aromatic hydrocarbons is governed by partitioning of hydrocarbon between sea water and lipid tissues in fishes. When fishes return to sea water, free from oil, they rapidly release the accumulated hydrocarbons from their tissues.

Analysis

Emissions are produced on drilling platforms which are mostly discharge into the ocean (Figure 1). Liquid and solid waste that are permitted to be discharged into the sea are, cooling water from machinery, domestic sewage, deck drainage, drill cutting, drilling fluids and produced water (Table 1).

The Table 1 above is used for the study showing discharged category of drilling fluids deck drilling and sewage. The data for investigation of

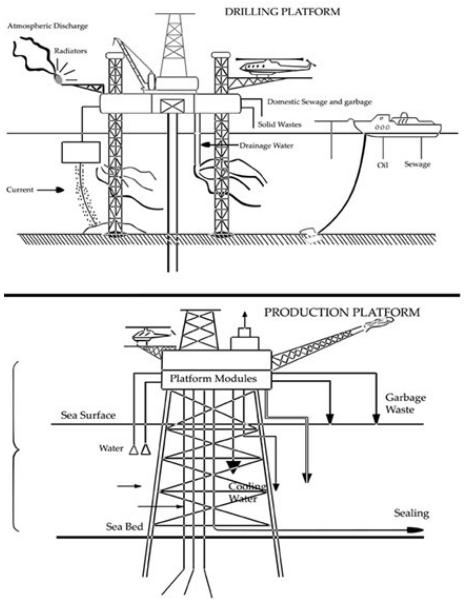

Figure 1: Sources of impact of the offshore drilling production platform.

oil drilling production is analysed in Table 2 indicating different types of additives and there different functions

Drilling engineering discharges

The major discharges associated with exploratory and developmental drilling are drill cuttings and drilling fluids. The drill cuttings are particles of crushed sedimentary rocks produced by the

***Corresponding author:** Paul CN, Department of Environmental Technology, School of Engineering and Engineering Technology, Federal University of Technology Owerri, Nigeria, Tel: +23483233546; E-mail: Paul_njoku2002@yahoo.com

Received September 29, 2018; **Accepted** November 3, 2018; **Published** November 12, 2018

Citation: Paul CN, Archana SN (2018) System Engineering Design of Offshore Oil Drilling Production Platform from Marine Environment. Oil Gas Res 4: 157. doi: 10.4172/2472-0518.1000157

Discharge category	Exploration	Development	Production.
A: drilling fluids			
(total additives to water based systems and volume discharged)			
Well depths less than 3050 m	520-709 tons/well		7090-21279 tons/platform
Well depths greater than 3050 m	672-2118 tons/well		10940-32380 m/platform
B: Drill cutting	823-1285 tons/well		9000-27000/platform
C: Produced water			0.2709 m/day/platform
D: Deck drilling	53 m/day	53 m/day	No information.
E: Sewage	53 m/day	53 m/day	0.7 m/day.

Table 1: Categories of major discharges from offshore oil and gas operations.

Additives	Functions
Sodium bicarbonate contamination.	Eliminates excess calcium ions due to cement contamination.
Sodium chloride	Minimizes borehole washed in salt zone.
Groundnut shells mica or cellophane	Minimize loss of drilling mud to formation.
Cellulose polymers or starch	Counter thick sticky filtercake decrease filter loss to formation.
Aluminum separate or alcohols	Minimize foaming.
Sodium chloride	Reduce viscosity increase in high temperature well aid deflocculation capability of lignosulfonate.
Diesel or vegetable oil lubricant	Reduce torque and drag on drill string.
Fill or oil based Paraformaldehyde bacteriocide	Counter different pressure sticking of drilling string. Fill is placed spotting fluid retard bacterial degradation in polymers fluids system, in development drilling added to fluid left behind in casing to prevent casing string corrosion.
Zinc compounds	Counter hydrogen sulphide contamination by preparing sulphides.
KC1-Polymer	Improve well-bore stability in well water sensitive shell formation drilling Prevent shell swelling and sloughing.
Asbestos	Improve solids carrying capacity. Lift formation

Table 2: Specially additives and their functions in water based drilling fluids.

action of drill bit as it penetrates into the earth. Cuttings are relatively inert, but sometimes they can be potential source of trace metals. They are responsible for continuous losses of small amounts of drill mud's which are removed by normal washing procedures [1,2].

The drilling fluids are especially formulated mixture of natural clays or polymers used as weighing materials either suspended in water or petroleum base. In the present study, water based drilling fluids are being used which contains sea water as the major liquid phase. Worldwide studies have revealed such water-based mud's to have lowest toxicity.

The major functions of drilling fluids are lubrication of drill bit, transport of cuttings to the surface, provide balance to subsurface and formation pressures, preventing blowouts as well as support part of the weight of drill bit and drill pipes. The five major items in water based drilling fluids clay, lignite and caustic, account for about 90% of the total mass of additives used in its preparation. Some common types of special additives and their functions in water-based drilling plants (Table 2).

The quantity of additives in drilling mud may vary with depth of the well. Heavy metals are present in drilling fluids. Metals of major environmental concern, due to their potential toxicity and abundance in drilling fluids include arsenic, barium, chromium, cadmium, copper, iron, lead, mercury, nickel and zinc. Heavy metals usually present in drilling fluids at concentrations significantly higher than those in natural marine sediments include barium, chromium, lead and zinc [3,4].

Result

Treatment and discharge

Drilling fluid is pumped under high pressure through drill pipes and exits through nozzles on the drill bit. The cuttings generated by the grinding action of drill bit are removed hydraulically. The drilling fluid along with drill cutting is then passed through several screens/devices, which remove the cuttings from the fluid. The drilling fluid is finally returned to holding tank for recirculation with subsequent discharge of cuttings to the oceans. The used drilling fluid is finally returned to holding tanks for recirculation with subsequent discharge of cuttings to the ocean. The used drilling fluids may be discharged intentionally in bulk quantities several times during a drilling operation [2].

The formation water is seen in rock formation, together with crude oil and gas before it is brought to the surface. It is difficult to accurately describe the chemical composition of formation water due to its persistence under high pressure and in the equilibrium with crude oil and gas in the formation. The produced water is the total water discharged during oil and gas extraction process. It comprises the water formation in association with oil and gas or injection water used for secondary oil recovery and various chemicals deployed in oil water separation process. Produced water contains dissolved and emulsified crude oil constituents, natural salts, organic chemicals and trace metals. It constitutes the major waste stream generated during offshore oil and gas production activities.

The produced water may be re-injected into the reservoir to enhance recovery of residual hydrocarbons in formation disposal alternative to avoid potential pollutants. The oil water mixture produced from a well is treated on production platform. The oil and water phases are allowed to separate in a gravity separator which is further treated to remove additional dispersed oil before being discharged into the ocean. A typical produced water treatment scheme can be deigned. The produced water discharged from a single platform is usually less than 1.5 MLD. The crude oil constituents will not be dispersed in particulate form into the water column below, except in unusual circumstances like

Activity	Potential effects.
Rig fabrication	Dredging and filling of coastal habitats mostly overseas.
Rig emplacement	Seabed disturbance due to anchoring.
Drilling	Discharge of drilling fluids and cuttings, risk of blowouts.
Routine rig operation	Dock drainage and sanitary waste.
Rig servicing	Discharges from support vessels and coastal port

Table 3: Offshore exploration of oil and gas field potential effects on marine and coastal environment.

Activity	Potential effects
Platform fabrication	Land use conflicts and increased channelization in heavily developed areas
Platform installation	Coastal navigation channels, sea bed disturbance resulting from placement and subsequent presence of platform
Drilling	Larger and more heavily concentrated discharges of drilling fluids and cutting risks of blowouts
Completion	Increased risk of oil spills
Platform servicing	Dredges and coastal port development discharges from vessels
Separation of oil and gas from water	Chronic discharges of petroleum and other pollutants
Fabrication of facilities and pipelines	Storage coastal use conflicts
Offshore emplacement of storage and pipelines	Sea bed disturbances, effects of structures
Transfer to tankers and Barges	Increase of risk of oil spills, acute and chronic Inputs of petroleum
Construction of onshore	Coastal use conflicts alterations of wet lands in
Facilities and storage	Pipeline corridors
Pipeline operations	Oil spills, chronic leaks

Table 4: Offshore development and production of oil and gas field potential effects on marine and coastal environments.

very rough seas, as the oil water interface is maintained. The interface water is usually treated through an oily water separator system before discharge.

The bilge water, which seeps into all floating vessels, is a minor waste from floating platforms. It is usually sea-water that gets contaminated with oil and grease as well as solids like rust, where it collects at lower sections of the vessels. The bilge water is directed to oily water separator system used for treatment of ballast water or produced water and discharged intermittently.

Discussion

The activities of the offshore segment of oil and natural gas industry invariably interact with the surrounding environment. These interactions are detailed in Tables 3 and 4. The impact of these interactions on air and marine environment is represented in the form of networks.

Conclusion

The study carried out is based on the design of oil drilling production platform and environmental impact assessment as shown in figure. The study indicates that the bilge water which seeps into the floating vessels, is a minor waste from floarting platform. It is usually sea-water that gets contaminated with oil and grease as well as solids like rust, where it collects at lower sections of the vessels. The bilge water is directed to oily water separator system used for treatment of ballast water or produced water and discharged intermittently. The production platform layout of the offshore drilling impact is formulated.

References

1. Paul CN (2003) System Approaches to Petroleum Energy Process Engineering and Environmental in Nigeria, Ad. Sc Engr. Thesis Substitute of Engineering. Department of Mechanical Engineering. M.M.M. Engineering College, Gorakhpur India.
2. Natural Environmental March Institute. Nogpur 1993.
3. (1983) Nigeria Natural Petroleum Cooperation Geology, Resources And Potentials pp: 306-331.
4. NNPC Oil Production Platform in the Niger-Delta 2009.