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Remote Operations Implementation: A Tool for Improved HSE Management

By

Dr Francis Idachaba*

Abstract.
The current security challenges and hazards associated with oil and gas operations especially in the Nigerian Niger Delta calls for an innovative approach to managing the operations to reduce the exposure of staff to these hazards and risks without compromising the asset integrity and operations philosophy. Remote operation is defined as the remote monitoring and control of the field based production systems from an offsite location with the aim of optimizing the entire production process. It involves the continuous collation of operational data using smart instruments, the transmission of these data using a robust and secure communication link and the integration of these data to the company's IT infrastructure comprised mainly of a data historian and production optimization tools. It provides the relevant personnel with information on the field performance and also provides an avenue for intervention while minimizing the exposure of the staff to the Health Safety and Environment (HSE) hazards associated with the fields. Remote operation has been shown to also reduce the Operational Expenses (OPEX) by reducing the number of field visits and the associated logistics and security costs and enhancing the field performance in terms of faster and more accurate interventions thereby enabling a better HSE

Introduction

Oil and Gas production facilities are located in harsh remote locations ranging from the arid and warm locations of the Middleast to the frigidly cold regions of the arctic regions to the hostile and unpredictable deep offshore regions and the swamp locations of the Niger delta. Operating in these locations requires that personnel be moved either by helicopter, boats escorted by military gunboats or military escorted land transport. The high cost of managing these operations required some form of arrangement where personnel are lodged in these locations in smaller groups with two to four week work rotations for those who are field based. The personnel live together and as such their activities have to be coordinated to maximize the space, time and the resources available. This results in more people being in the same place at the same time. Despite the advantages, associated health complications such as rapid spread of diseases especially from contaminated food and water, demands more onsite medical facilities.

*Dr Francis Idachaba (Former Sabbatical Fellow in Shell Petroleum Development Company of Nigeria) is a Senior Lecturer in the Department of Electrical and Information Engineering, Covenant University Ota, Ogun State, Nigeria.

The personnel are also exposed to risks from accidents and attacks on the facility. Companies have put in place different schemes and strategies aimed at reducing the risks their staffs are exposed to and these range from robust evacuation plans with dedicated helicopters, explosion proof buildings at these locations and the heavy presence of military personnel at these sites.

For onshore operations, the advent of militancy also introduced a different dimension to the risks as staff were being attacked and kidnapped enroute to their work sites by road. This also led to a further increase in the number of military personnel involved with the oil and gas field operations with the introduction of lead and chase vehicles carrying up to six armed military personnel escorting the bus conveying oil and gas personnel to and from the field locations. Operations in swamp locations also experienced the impact of militancy and operators had to invest in a huge military presence in those areas by acquiring house boats for the soldiers' accommodation, diesel and generators for power, feeding and military gunboats to provide cover whenever the personnel have to go to any of the wellhead locations

Offshore locations are not predisposed to militancy attacks as the onshore locations. Nonetheless they rely totally on helicopters for transportation of personnel and equipment thereby increasing the vulnerability of the personnel to accidents (added to the limitation on weights that can be airlifted at once by these helicopters). Space constraints on these platforms coupled with high cost of helicopter lease per day, encumbers the parking of these helicopters on these platforms. This further increases risks as personnel would not be attended to fast enough in the case of an emergency requiring evacuation of personnel.

Key activities on an oil producing site

Oil and gas fields have been known to be productive for up to 100 years. The phases for both onshore and offshore sites can be classified into three broad groups[11] (after a successful seismic survey) depending on the phase of the production process. These activities are

1. Drilling
2. Operations monitoring and control
3. Maintenance and upgrade

The drilling phase involves activities ranging from drilling with the drilling rig and other associated equipment, installation of the casings and finally the wellhead installation. These operations are highly capital intensive and accidents resulting from the operations are usually very fatal with up to very high fatality rates for offshore locations[2].

[1] Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development. International Finance Corporation April 30th 2007

[2] Burgherr .P and Stefan.H. Comparative Assessment of Natural Gas Accident Risks. Paul Scherrer Institut (PSI) January 2005

The operations phase involves the actual operation of the wellhead for the purpose of extracting the crude oil from it and transporting the oil safely using flow lines and trunk lines to the flow station for the purpose of oil separation. After separation, the oil is transferred to either the refinery or the export points for sale depending on the operators' business plan. During this phase the personnel activity is more at the flow station. The monitoring involves operators taking the temperature, pressure, differential pressure, and flow rate measurements of the crude oil flow from instruments installed at the wellhead. This data is required to enable proper management of the oil and gas reservoir as it enables the decisions on the control of the production process by varying the beam or production choke size. The maintenance and upgrade activities range from equipment maintenance, overhaul or replacement. These activities are executed to keep the field producing optimally with the asset's integrity maintained.

Remote Operations

Remote operation can be defined as the process of operating, monitoring and controlling devices installed in the field location from a secure remote location. Typical remote operation activities include:

1. *Remote drilling*: With remote drilling the control of the drill rig and the other associated equipment can be executed or effected from a secure remote site with the results and drill data being streamed in real time.
2. *Remote monitoring:* This involves the use of special remote telemetry units for the transfer of the temperature and pressure data from the field location to the company's IT network through the flow station data network. These production data can then be viewed from any location where there is an access to the company's IT network bound by security clearances.
3. *Remote control:* This involves the use of special remote telemetry units for the transfer of control signals from the office or process domains to control chokes and valves in the field locations. Existing valves can also be retrofitted with electronic actuators to allow the control of the valves with the electronic signals sent from the remote control site. These control signals and the results can subsequently be viewed from any location where there is an access to the company's IT network subject to the security clearances.

Oil and Gas Trends

As the era of easy oil gradually comes to an end, operators have begun or embarked on exploring the more challenging, more dangerous and more expensive regions of the deep offshore which further buttresses the need for remote operations to limit the personnel exposure to HSE risks associated with these locations. Deepwater oil and gas activity in Africa extends from Mauritania to Angola, where the region has witnessed offshore production holding an increasing share in total oil and gas production, growing from 58.9% in 2001 to 78.3% by 2011. Nigeria and Angola are the largest producers of oil and gas in Africa, accounting for approximately 77.7% of the region's total offshore oil and gas production during the course of 2001 - 2011. Throughout

January 2009 - June 2012, Angola accounted for 17 of a total 47 deep offshore oil and gas discoveries made in West Africa. Offshore oil and gas production in the West African region increased from 843.7 MMboe in 2001 to 1564.2 MMboe in 2011, at an Annual Average Growth Rate (AAGR) of 6.2%, and is expected to increase further to 2201.6 MMboe in 2020 at an AAGR of 3.8%, in view of anticipated projects or projected strategies[3].

Oil and Gas HSE challenges

Overall, the main cause of incidents occurring in oil and gas environments leading to fatalities can be attributed to human error, followed by equipment failure and majority of these incidents occurred during production operations[4]. Offshore facilities should therefore be designed to eliminate or reduce potential injuries and accidents. The crew size on an offshore platform can range from 10-15 for small, near-shore facilities, to as many as 150-200 members for larger operations. The living quarters include a cafeteria-type kitchen, recreation and exercise rooms, medical facilities, laundry rooms, maintenance shops, warehouses and laboratories. The operations are continuous and require coverage by day and night crews, who live on the platform during their entire time offshore. Typically one crew works on the platform for a 14-day stretch, while another enjoys their 14 days off at their homes, many pursuing side jobs or hobbies[5].
Deepwater and shallow water projects alike pose risks of blowouts, explosions, fires, and injuries to workers, spills and contamination of ocean and coastal environments, disruption of socio-economic activities, and destruction of corporate facilities and other assets[6]. The fatality rate for offshore incidents is very high with very minimal survival rates. These incidents occur mainly during the production phase of the facility[7].

Remote Capability Implementation for improved HSE Management

This involves the development of a real time control interface between the platform (or any other offsite location) and the desired (secure) operational base where the personnel will be stationed The system will provide both data and images of the work environment and enable the engineers

[3] Farrell. P. West Africa sees oil and gas boom in offshore areas. http://www.energyglobal.com/sectors exploration/articles/Oil and gas production booming inWestAfrica.aspx Published on 23/08/2012.
[4]Incidents Associated with Oil and Gas operations. Outer continental shelf 1998. US Department of the Interior. Minerals Management Service. Engineering and Operations Division.
[5] Oil and gas offshore production. SHELL Alaska
[6] Baram M. Preventing Accidents in Offshore Oil and Gas Operations: the US Approach and Some Contrasting Features of the Norwegian Approach. Deep water Horizon Study Group Working Paper – January 2011
[7] OGP Risk Assessment Directory. Major Accidents No: 434-17 International Association of Oil and Gas Producers March 2010.

to execute the desired operations on the site through systems controlled from the secure locations in the operations base.

This can be achieved by

(1) The development of machine control systems and interfaces
(2) The development of real time communication system architecture between the offsite locations and the different operation bases or control sites.
(3) The development of a real time control system architecture for offsite automation of the different industrial systems and processes.

The deployment of Remote Operations has the capability of providing the following HSE management improvements[8].

1. The crew size at the production sites will be reduced thereby rendering better health management and control of any disease outbreak.
2. More of the crew will be located in more secure urban areas with access to better and adequate medical services without requiring any emergency evacuation involving helicopters or armed transport.
3. The fewer personnel at the production sites will enable the provision of better security cover and fewer evacuation trips in the event of a hazard. It will also reduce the casualty rates in the event of an accident at the site
4. The absence of personnel at the remote sites reduces the risk of kidnapping.
5. The system will reduce the risks and eliminate costs associated with moving experts to offsite locations by allowing them to work from secure locations.
6 The system will utilize existing communication infrastructure present at the offsite locations and its deployment will not require any alteration in the existing industrial layout.
7 The system will reduce response time and enhance the productivity of the staff involved, due to the safety and comfort of their work environments in the control centers.
8 Maintenance processes can be incorporated in the system to enable the execution and control of maintenance operations from remote locations.
9. The error rates can be greatly reduced by the utilization of robust computer algorithms and automated systems for the operations of these facilities thereby minimizing accidents leading to environmental degradation.

[8] Idachaba F.E Robust Communication Architecture for Remote Operation of Oil and gas production Installations in the Niger delta. Volume 01 Issue 03 July 2011, pp 55-59 Asian Transactions on Engineering Asia. 2011.

Conclusion

The deployment of Remote operation supported by robust control algorithms has the potential of minimizing the HSE exposure of personnel to hazards associated with moving and staying at these remote sites as well as the ability of minimizing accidents due to human error.