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IMPORTANCE OF CONDITION BASED MAINTENANCE OVER TRADITIONAL MAINTENANCE IN OIL AND GAS PLANTS

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Abstract

This article provides an overview of the two types of maintenance discussed: traditional maintenance and condition-based maintenance. The article discusses condition-based maintenance techniques and how they affect maintenance decision-making. It also provides useful decision-making information using condition-based maintenance techniques. The article concludes with important points for further research.

Keywords

condition based maintenance, traditional maintenance, oil and gas, technology, industry, efficient work.

Introduction

Since time immemorial, humanity has been familiar with oil and gas. According to Archaeologists and historians, the peoples of Asia Minor, Egypt and China used oil in the 4-5th millennium BC. In many areas of the world, oil and gas outlets were considered sacred. It was then used for medicinal purposes, for lighting, lubricating mechanisms, as an incendiary in war, and as a building material. The oil and gas industry is one of the branches of heavy industry, which includes exploration of gas and oil fields, conducting surveys, drilling wells, extracting oil and gas, and organizing the transportation of extracted resources through the laying of pipelines.

The oil and gas sector in Uzbekistan is not only one of the main directions of economic development, but also ensures the country's security and energy independence. Uzbekistan is a strategically important country in the region because, due to its geographical location, it is located in the heart of Central Asia. At the same time, it is the only country that borders all other states in the region. However, unlike its closest neighbors Kazakhstan and Turkmenistan, Uzbekistan is not a major exporter of energy resources, even despite the country's significant reserves of hydrocarbon resources. Uzbekistan has large reserves of natural gas, which is mainly used for domestic consumption. The oil and gas industry accounts for about 16% of the national GDP and more than 20% of budget revenues. According to BP's 2020 Statistical Review of World Energy, Uzbekistan's total proven natural gas reserves amount to 1.2 trillion cubic meters. Natural gas accounts for the majority of energy consumption (88%), petroleum products - 5%, coal - 2% and hydroelectricity - 5%. High domestic gas consumption is due to the government using gas as a subsidy for local industry and a direct economic benefit for the population. The vast majority of exploration, development and production was carried out by the state-owned Uzbekneftegaz company. Current domestic production is estimated at approximately 61 billion cubic meters. m in 2020, and is mainly used to meet high domestic consumption, which is estimated at 45 billion cubic meters. m of gas in 2020 [1].

Materials and Methods

Trends in modern manufacturing are associated with ever-increasing requirements for equipment performance, positioning accuracy, quality of machined surfaces and reduced production costs. Domestic machine-building enterprises are characterized by high costs for maintenance and repairs. Maintenance and repair (MRO) based on the actual condition of process equipment, determined using in-place diagnostic tools, reduces the costs associated with routine maintenance by 20–25% compared to scheduled preventive maintenance [2]. However, diagnostics alone is not enough, since there is a need for large warehouse stocks of all components, especially if the equipment at the enterprise is diverse. Reducing warehousing costs can be achieved by ordering the necessary components strictly as needed, based on diagnostic data [3]. But the low development of the logistics system in our country and the high share of imported equipment make prompt delivery impossible. Hence the need arises to predict the moment of a possible malfunction based on diagnostic data. However, at present there are no predictive models that would take into account the time-varying statistical characteristics of the operating equipment and have high accuracy. Therefore, there is a need to develop an adequate mathematical description of the forecast, forecasting algorithms, selection of a diagnostic signal and methods for collecting diagnostic data.

Over the last few decades, maintenance functions have drastically evolved with the growth of technology. Maintenance is defined as a set of activities or tasks used to restore an item to a state in which it can perform its designated functions (Dhillon, 2002; Duffuaa, Raouf, & Campbell, 1999). Maintenance strategies can be broadly classified into Corrective Maintenance (CM) and Preventive Maintenance

(PM) strategies (Duffuaa, Ben-Daya, Al-Sultan, & Andijani, 2001). Corrective maintenance, also known as run-to-failure or reactive maintenance, is a strategy that is used to restore (repair or replace) some equipment to its required function after it has failed (Blanchard, Verm, & Peterson, 1995). This strategy leads to high levels of machine downtime (production loss) and maintenance (repair or replacement) costs due to sudden failure (Tsang, 1995). An alternative to the CM strategy is the PM strategy. The concept of PM involves the performance of maintenance activities prior to the failure of equipment (Gertsbakh, 1977; Lofsten, 1999). One of the main objectives of PM is to reduce the failure rate or failure frequency of the equipment. This strategy contributes to minimising failure costs and machine downtime (production loss), and increasing product quality (Usher, Kamal, & Syed, 1998).

Results

While traditional maintenance continued to dominate all industries until the 1970s, preventative and then condition-based maintenance became commonplace as technology became cheaper. Industrial Maintenance.

Maintenance is therefore important wherever facilities are used to create value for the organization. However, the main need here belongs to industry. Maintenance in industry is a key component of economic production because maintenance costs account for a significant portion of total production costs.

Over the course of time, various Maintenance concepts have been established in the industry. Basically there are three types.

- Corrective maintenance
- Preventative maintenance
- Predictive maintenance

Discussion

The reliability of the equipment used in the oil and gas complex is the main feature of the efficient operation of the entire system. Increasing reliability is the most important task of mechanical engineering, which makes it urgent to study the causes of equipment failure. The purpose of the study is to provide condition-based maintenance of the equipment used in the oil and gas complex.

To achieve this goal, it is proposed to solve a number of tasks necessary for a comprehensive study of the problem: consider the statistics of equipment failures and identify the main causes of failures; analyze the current state of the oil and gas complex; develop a project to optimize maintenance and repairs.

The bulk of accidents occur due to a violation of the tightness of equipment (46%), due to external influences of a man-made nature (22%), personnel errors (17%), external influences of a natural nature (6%) and uncontrolled releases of oil or gas from a well (9%) [4].

Condition-based maintenance (CBM) is a strategy that monitors the actual condition of an asset to decide what maintenance needs to be done. CBM dictates that maintenance should only be performed when specific indicators show decreasing performance or upcoming failure. Checking a machine for these indicators may include non-invasive measurements, visual inspection, performance data, and scheduled tests. Condition data can then be gathered at specific intervals or continuously (as is done when a machine has internal sensors). Condition-based maintenance can be applied to mission-critical and non-mission-critical assets[6].

Condition-based maintenance (CBM) offers several advantages specifically tailored to the complex and critical operations within the oil and gas industry:

Maximized Production Uptime: Oil and gas operations are often highly dependent on the continuous functioning of complex machinery and equipment. CBM allows for the early detection of potential failures, enabling proactive maintenance interventions. This minimizes unplanned downtime and ensures that production targets are met consistently.

Enhanced Safety and Environmental Protection: The oil and gas industry operates in environments with inherent risks. CBM helps identify equipment issues that could pose safety hazards or lead to environmental incidents. By addressing these issues promptly, CBM contributes to a safer work environment and reduces the likelihood of accidents or spills.

Optimized Equipment Performance: CBM enables operators to monitor the health and performance of critical equipment in real-time. By analyzing data trends and identifying patterns indicative of degradation or impending failures, operators can optimize the performance of their assets. This leads to improved efficiency, reduced energy consumption, and extended equipment lifespan.

Cost Reduction: Unplanned downtime and equipment failures can result in significant financial losses for oil and gas operators. CBM helps minimize these losses by avoiding costly emergency repairs and reducing the need for unnecessary preventive maintenance. By prioritizing maintenance activities based on actual equipment condition, CBM also optimizes resource allocation, leading to cost savings in the long run.

Compliance and Regulatory Requirements: The oil and gas industry is subject to stringent regulatory requirements aimed at ensuring operational safety and environmental stewardship. CBM facilitates compliance with these regulations by providing visibility into equipment health and enabling timely maintenance actions. This helps operators demonstrate due diligence and adherence to regulatory standards.

Remote Monitoring and Diagnostics: Many oil and gas facilities are located in remote or offshore locations, making regular onsite inspections challenging and costly. CBM leverages remote monitoring technologies and predictive analytics to assess equipment condition from a distance. This reduces the need for physical inspections and allows for early intervention, even in hard-to-reach areas.

Data-Driven Decision Makin: CBM generates vast amounts of data from sensors and monitoring systems. By harnessing this data and applying advanced analytics techniques, operators can make informed decisions regarding maintenance strategies, equipment investments, and operational improvements. This data-driven approach enhances overall decision-making processes and contributes to continuous performance optimization.

Conclusions

In summary, the importance of CBM over traditional maintenance in oil and gas facilities is its ability to reduce costs, minimize downtime, improve safety, optimize asset performance, and provide predictive maintenance planning for production uptime. provide significant benefits by improving safety and environmental protection, optimizing equipment performance, reducing costs, ensuring regulatory compliance, remote monitoring, and facilitating data-driven decision-making. As the industry continues to evolve, CBM plays an increasingly important role in maximizing operational efficiency and sustainability.

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