Decisions in decommissioning projects: bringing health and safety closer to future work

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Abstract

Decommissioning industrial facilities in Brazil poses challenges for ensuring safe and efficient shutdowns, considering risks like safety and health. Linking decommissioning with operational risk management methods can lead to resource savings, improved worker safety, assessment of future scenarios, and enhanced transparency among stakeholders. This study aims to compare Worker Health and Safety data using a decision analysis method developed by COPPE/UFRJ, to determine optimal decommissioning options for subsea installations. It utilizes data from SAFETEC Report and CNAE to analyze operational risks. In Brazil, worker safety faces unique challenges, and understanding effective decommissioning activities can guide future work and reduce risks for workers in this sector.

Keywords: Decommissioning, Safefy, Work Activity.

1 Introduction

Several offshore oil and gas platforms, installed in recent decades to provide global energy, now need to be decommissioned (Gourvenec, 2018). Currently, the operational lifespan of these installations is coming to an end, and their decommissioning raises growing concerns about environmental, social, economic, and health impacts on the people involved (Watson et al., 2023).

According to Petrobras (2023), decommissioning is the permanent cessation of operations of a platform and its associated equipment when there are no more opportunities for continued production. This process can be lengthy due to the removal of complex structures, government regulations, and consultation with various stakeholders (Caprece, 2023).

The number of offshore oil and gas platform decommissioning projects is increasing, especially in Brazil, where a significant amount is expected in the coming years. The International Association of Oil & Gas Producers (IOGP) estimates that by 2030, around 80 offshore platforms and a large amount of subsea infrastructure will be decommissioned due to aging installations and the need to comply with environmental regulations (IOGP, 2023). In Brazil, studies on the topic of decommissioning offshore oil and gas production systems are on the rise due to the completion of many production projects. Given the country's geographical and environmental diversity, it is crucial to analyze each unit individually (Muniz, 2020), especially when decommissioning in the South Atlantic waters, which differs from experiences in other locations.

Brazil, with its vast territorial expanse, offers a variety of scenarios for the decommissioning of subsea equipment. This includes everything from shallow waters to ultra-deep waters that can exceed 5,000 meters. The country also has a diversity of biotas, invasive species, and ecosystems, as well as a wide range of equipment used in oil exploration, such as the large number of flexible pipelines. This context is distinct from that of other countries (Delgado & Michalowski, 2021). The decommissioning challenge in Brazil involves the safe and efficient shutdown of installations, taking into account various environmental, economic, technical, and social factors, along with operational risks and worker health considerations. Both onshore and offshore activities associated with each chosen decommissioning method must be evaluated to address these complex requirements effectively.

This study aims to present the results of applying the Multicriteria Analysis Methodology to select the best decommissioning alternatives for subsea equipment of a platform in Brazil. It promotes the discussion on the comparative analysis of Occupational Health and Worker Safety data, using information from the Safetec (Safety and Environmental Technology) report and the CNAE (National Classification of Economic Activities) codes to evaluate operational risks.

1.1 The decommissioning process

The Decision Support Methodology for Decommissioning Subsea Oil and Gas Production Systems (MCDA - Multi Criteria Decision Analysis), developed by COPPE/UFRJ, is used in this study for comparative analysis. In the Decommissioning Project, it is essential to characterize each alternative based on six criteria: Environmental, Technical, Waste, Economic, Social, and Health and Safety, the latter being the focus of the study. The variation of operational and local parameters requires a systematic procedure for decommissioning, considering various scenarios (COPPE, 2022).

1.2 The Health and Safety Criterion

In the application of the MCDA methodology, Occupational Health and Worker Safety aspects are evaluated through five subcriteria. Three are related to Occupational Health (Exposure to Toxic Materials, Exposure to NORM, and Exposure to Hyperbaric Conditions), while two deal with Worker Safety (Fatal Accidents and Impacts on Other Sea Users). The scores for each subcriterion are determined based on risk assessment, considering the decommissioning alternatives and their corresponding activities (COPPE, 2022).

2 Methodology

This research can be characterized as a case study as described by Yin (2015), with the aim of defining parameters and systematizing results within an existing context. Thus, five stages were followed:

In the first stage of the MCDA Methodology application process, an exploratory and descriptive study was conducted. In this study, each alternative was evaluated for its impact on six criteria, one of which was related to Health and Safety (COPPE, 2022). In the second stage of the process (referred to as "Literature Investigation"), a detailed search was conducted to deepen understanding of the topic. The focus of this research was on subsea equipment, especially flexible pipelines of an FPSO vessel. For this study, a comparative simulation was conducted between the Health and Safety data presented in the SAFETEC Report and the data obtained through the CNAE Codes, applied in the calculation methodology of the MCDA method. This specific analysis focused on a section that will be decommissioned for the removal of subsea oil and gas production equipment.

In the third stage of the process (referred to as "Research Protocol"), a detailed plan was developed for data collection. This protocol aimed to gather the following information: the CNAE activity codes related to the decommissioning process; onshore and offshore activities associated with these codes; onshore and offshore activities described in the Safetec Report; and finally, the Fatal Accident Rates (FAR) from the two analyzed methodologies (CNAE Codes and Safetec). In the fourth stage of the process (titled "Assay"), a comparative analysis was conducted in May 2024. This analysis focused on a specific section of the subsea equipment that would be decommissioned on the FPSO vessel. For this comparison, the FAR related to a set of activities linked to the decommissioning process between the Safetec documents and the CNAE Codes were evaluated. In the fifth stage, the process involving the comparison between the two methodologies was analyzed in detail.

2.1 The Decommissioning Project - Case Study

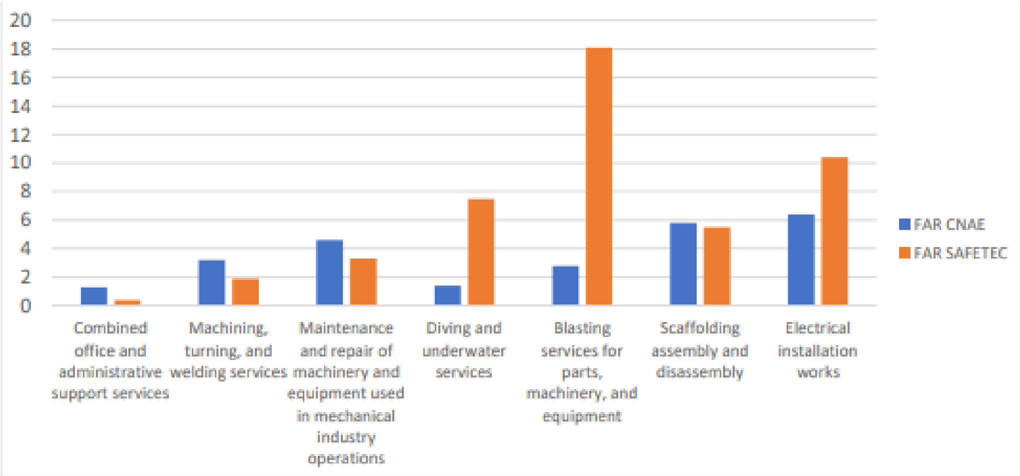
The Z platform analyzed in this study is a Floating Production, Storage, and Offloading (FPSO) unit, which serves two deepwater fields off the Brazilian coast in the Campos Basin. The decommissioning alternatives proposed for this case were: Total Removal via Reverse Coil, Total Removal via Cutting and Lifting, and In Situ Retention.

3 Results and Discussion

In the Brazilian context, there are no detailed records of fatalities in workplace accidents during the decommissioning of offshore oil and gas production equipment. However, the National Institute of Social Security annually releases Mortality Rate indices related to activities categorized in the CNAE registry (AEAT, 2017). These codes are used for health and safety analyses in evaluating decommissioning alternatives. However, these data are not reliable because there is no identification and categorization of decommissioning activities by these codes. On the other hand, the Safetec Report, developed in collaboration by companies such as Shell, BP, and the UK Health and Safety Executive, quantifies risks and workplace accidents during the decommissioning of oil and gas production facilities in the North Sea. This methodology reviews analytical methods associated with serious accident risks and identifies data sources to estimate the FAR (Safetec, 2005).

To meet the study objective, activities correlated between the CNAE Codes and the Safetec Report were analyzed. Comparing data from the two methods allows understanding FAR values in different contexts, such as the Brazilian oil and gas industry. Figure 1 presents this comparison in a section of flexible pipelines of the FPSO vessel under study.

Figure 1 - Comparison of the FAR between the two methodologies in section 1.1.I.



Source: Developed by the authors (2024)

From the graph above, some points can be concluded:

1- The graph shows a significant discrepancy in FAR, especially in the activities of "Diving Services", "Sandblasting Services for Parts, Machinery, and Equipment", and "Electrical Installation Works". These differences in values presented by the CNAE Codes and the Safetec Report may reflect variations in operational processes, specific risks associated with decommissioning, and working conditions in each sector. 2- Limitations of the CNAE Codes: The disparity highlights a gap in considering specific decommissioning activities by the CNAE Codes. Although these codes broadly classify economic activities, they do not specifically focus on decommissioning operations, which involve distinct processes and risks (IBGE, 2007). The lack of specific categorization may affect the accuracy of risk estimates and the adequacy of safety measures associated with these operations. 3- Importance of Complementary Sources: Therefore, it is necessary to resort to complementary data sources, such as the Safetec Report, which focuses on decommissioning operations, allowing for a more accurate assessment of associated risks. By aligning with the reality of offshore work, it is possible to contribute to technological development and enhance Worker Health and Safety, enabling a better understanding of FAR in different decommissioning alternatives (AEAT, 2017; IBGE, 2007; Safetec, 2005).

Within the understanding of work, resilience engineering emerges as an innovative approach that considers how people react under constant pressure in the workplace, recognizing that under pressure, individuals may act more recklessly, increasing the risks of accidents. In the context of subsea equipment decommissioning, this approach can be applied to understand how productive systems and work teams adapt and recover from unexpected events. However, it is crucial to go beyond resilience engineering and consider human factors more comprehensively, promoting the identification and implementation of conditions that favor a positive contribution from operators and work collectives in industrial safety construction (ICSI, 2010). The concept of human factors, proposed by Daniellou (2001), emphasizes understanding the interactions between workers, tasks, and the work environment. This includes aspects such as skills, training, communication, decision-making, and cognitive load. By incorporating human factors, we can enhance the safety and health of workers during subsea equipment decommissioning.

Transitioning from resilience engineering to considering human factors can allow for a more comprehensive analysis of the risks and challenges faced by teams involved in decommissioning. Understanding the actual work of operators (Daniellou, 2007), and how they interact with systems, what their capabilities and limitations are, and how decisions are made in critical situations is essential for mitigating accidents and promoting a safe work environment. This holistic approach will enable us to develop more effective strategies to protect workers and ensure the integrity of operations throughout the decommissioning process.

4 Final Considerations

Analyzing the comparative data produced during the simulation proposed in the study highlights the challenges of decommissioning subsea equipment in the Brazilian context to enhance occupational risk management. The disparity in FAR results for certain correlated activities from both documents, the lack of documents with health and safety information about decommissioning activities, underscores the need for complementary data sources, such as the Safetec Report, covering the Brazilian reality. Additionally, the transition from resilience engineering to considering human factors emerges as an essential approach to understanding how workers interact with systems and make decisions in critical situations.

It is necessary to recognize that the research had limits imposed by its temporal historical scope, and proactively considering them will contribute to new simulations and studies seeking to improve the Health and Safety criterion. Thus, this study aims to provide insights for discussion and the development of future research in the field of decommissioning of subsea oil and gas production systems.

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