
Reliability-Based Maintenance Strategy Selection for Dredging Systems in Floating Mining Operations using RCM, FMEA, and Weibull Analysis

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Abstract:

Production Suction Vessels (KIP) are critical assets in offshore tin mining operations where failures in dredging systems can significantly affect operational availability and production continuity. In the observed system, maintenance practices that were not supported by reliability analysis contributed to frequent unexpected breakdowns and increased downtime. This study aims to determine an appropriate maintenance strategy for the KIP dredging system using an integrated Reliability-Centered Maintenance (RCM), Failure Mode and Effects Analysis (FMEA), and Weibull reliability analysis approach. FMEA was applied to identify critical components based on Risk Priority Number (RPN), while Weibull distribution analysis was used to evaluate component failure behavior patterns. The analysis showed that most critical components exhibited infant mortality failure characteristics ($\beta < 1$), while several components demonstrated random failure behavior ($\beta \approx 1$). Based on these findings, maintenance strategies were selected according to the reliability characteristics of each component to improve maintenance effectiveness and reduce unplanned downtime. This study contributes to reliability-based maintenance decision-making in offshore mining operational systems.

Keywords:

Reliability-Centered Maintenance, FMEA, Weibull Analysis, Maintenance Strategy, Dredging System.