Prediksi Penilaian Risk-Based Inspection untuk Mengoptimalkan Rencana Inspeksi & Meminimalkan Kerugian Menggunakan Machine Learning untuk Infrastruktur Transmisi Gas di PT. PGN Tbk = Prediction of Risk Based Inspection Assessment to Optimize Inspection Plan & Minimize Losses Using Machine Learning for Gas Transmission Infrastructure in PT. PGN Tbk

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Abstrak

Risk-Based Inspection (RBI) adalah metodologi untuk menentukan risiko pada peralatan sesuai dengan siklus hidupnya untuk mengoptimalkan rencana inspeksi yang membutuhkan penilaian kualitatif atau kuantitatif terhadap probabilitas kegagalan (POF) dan konsekuensi dari kegagalan (COF) yang terkait dengan masing-masing item peralatan, termasuk perpipaan, dalam unit proses tertentu dengan tujuan meningkatkan keselamatan operasional dan kehandalan fasilitas industri. Penelitian ini bertujuan untuk mengetahui prediksi risiko dataset infrastruktur transmisi gas di PT PGN Tbk, analisis perbandingan antara hasil penilaian risiko dengan machine learning dan penilaian RBI secara manual, serta optimalisasi program inspeksi RBI. Tahapan penelitian adalah pengumpulan data, rekayasa fitur, pelatihan model, evaluasi model, peningkatan model, analisis perbandingan, analisis risiko biaya dan optimalisasi program inspeksi. Hasil analisis perbandingan adalah dengan logistic regression (LR) sesuai 89,84%, support vector machine (SVM) sesuai 98,53%, k nearest neighbours (K-NN) sesuai 97,79%, decision tree (DT) sesuai 99,26% dan random forests (RF) sesuai 99,85% yang merupakan algoritma machine learning yang terbaik dengan menggunakan ukuran data test sebesar 10%. Berdasarkan analisis risiko biaya, biaya inspeksi dengan teknik RBI secara manual dan menggunakan machine learning memperoleh pengurangan biaya sebesar 60,83% daripada program inspeksi tidak berbasis risiko. Hasilnya menunjukkan bahwa dengan menggunakan machine learning dapat memprediksi tingkat risiko inspeksi berbasis risiko, mengoptimalkan rencana inspeksi, dan menurunkan biaya inspeksi.

.....Risk-Based Inspection (RBI) is a methodology for determining risks on equipment in accordance with its life cycle to optimize inspection plan that requires qualitative or quantitative assessment of the probability of failure (POF) and the consequences of failure (COF) associated with each item equipment, including piping, within a certain process unit with the aim of increasing the operational safety and reliability of industrial facilities. This study aims to determine the risk prediction of gas transmission infrastructure dataset at PT PGN Tbk, a comparison analysis between the results of the risk assessment of machine learning and the RBI assessment manually, as well as an optimization of RBI inspection program. Stages of research are data collection, feature engineering, model training, model evaluation, model enhancements, comparison analysis, cost risk analysis and optimization of inspection program. The results of comparison analysis are with logistic regression (LR) match 89.84%, support vector machine (SVM) match 98.53%, k-nearest neighbours (k-NN) match 97.79%, decision tree (DT) match 99.26% and random forests (RF) match 99.85% which is the best machine learning algorithm by using a data test size equal to 10%. Based on cost risk analysis, inspection costs with RBI techniques manually and using machine learning obtain a reduction in costs by 60.83% than inspection program not risk based. The result shows that

using machine learning, it could predict the risk level of risk-based inspection, optimize the inspection plan, and lower the inspection cost.