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Application of Bayesian network in estimating human error probability: A case study in a petrochemical plant

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Along with the improvement of equipment reliability, human error has become a great threat to the oil industry reliability and safety. Statistics show that human error is a major contributor to over 80% of accidents in chemical and petrochemical industries. Therefore, in order to ensure effective prevention of catastrophic accidents, the role of human in accident dynamics should be considered during risk assessment processes. The purpose of this study is to provide a method for estimating the instant and precise of human error probability (HEP) using cognitive reliability and error analysis method (CREAM) and Bayesian network. For this purpose, data related to dynamic context (or common performance conditions) was collected by a self-design questionnaire. Then, the gathered data was processed via MSBNx software. The results indicate that the highest HEP value is associated to the outside operators with 0.0912. In this study, factors such as unavailability of procedures/plans, multiple simultaneous goals, inadequacy of training and experience, and poor crew collaboration were identified as the common performance conditions that could effect on the HEP. Therefore, the method can be used as a useful and applicable tool to estimate the HEP value, in particularly in complex and uncertain systems such as oil industries.

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The probabilistic assessment of pipeline strength reliability

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The assessment of pipeline strength reliability is one of the key focus areas at both design and operation stages of a pipeline system. The correct and verified pipeline strength assessment influences operating costs, economic and ecological risks and pipeline system efficiency. Investigation of the issue becomes harder due to the strength probability and non-failure operation of pipelines which depend on a vast number of factors, some of them are independent and could not be controlled and others are defined as random. This paper aims to specify the most appropriate method for evaluating non-failure operation by using a probabilistic approach. The problem is stated as follows: How to assess the non-failure operation probability in case the applied stress exceeds the admissible stress? The probability of failure operation is determined as an overlap area of distribution density functions of stresses and admissible stresses. The reconstruction of probability distribution's density is calculated on random variable sample of the ultimate stress limit s and the σ-stress, which are defined on various sections of pipelines as random variables. Due to the large number of laws of random variables distribution in the framework of the parametric statistics; as well as impossibility of formulating the conditions for attributing the sample (during the results processing of a certain value measurement) to a particular distribution law in some cases, the most effective approach is based on the nonparametric statistics methods. Thus, the software and methodological support was developed, aiming to restore the density distribution function of the random variables. The methodology allows assessing the strength reliability of objects under conditions of real spectrums of external load impact and the natural laws of change of ultimate material state.

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