

Towards a Reliable Decision Making on Safety Barriers Performance based on Expert Judgments in the Framework of BORA Approach

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Abstract

BORA (Barrier and Operational Risk Analysis) is relatively new approach developed for qualitative and quantitative risk and safety barriers analysis. It includes a barrier block diagrams, fault trees (FT), and risk influence diagrams combined for analyzing accident scenarios that may occur on oil and gas industries and assessing safety barriers performance. This recent approach has been chosen because of its analysis of operational factors (human, technical and organizational factors) that contributed in these accidents. Furthermore, a close attention that is given to safety barriers analysis. In fact, it allows analyzing the major accident scenarios and the performance of all safety barriers existing and opposing the occurrence of these scenarios. For this reason, the qualitative and quantitative analysis using barrier block diagrams and fault tree analysis (FTA) are applied, followed by influence diagram analysis, the effects of risk influencing factors (RIFs) on the initiating and basic events in the fault trees.

In the context of BORA, expert judgment plays an important role in quantifying the revised probabilities of failure on demand of safety barriers considering average probabilities of failure on demand P_{ave} (E) by aggregating weights (W_i) and scores (Q_i) for each RIF. When the judgments of multiple experts are elicited, mathematical aggregation methods can then be used to combine these individual judgments into a single judgment for calculating the P_{FDrev} . Using these methods, the risk analysts are able to combine these judgments in order to make better evaluation/decision about performance of safety barriers on terms of reliability, availability, effectiveness, response time and confidence level...etc.

As known, three categories of aggregation methods are evoked by researchers and scientists and carried out in different fields. Namely, conjunctive methods, compromise methods and disjunctive methods. Notes that, each method is selected taking into account the nature of opinions and data dissemination given by experts. These methods will be introduced and compared through following sections.

In the extant literature, many works were developed in the context BORA approach. A whole series of papers were submitted by Skelt et al, where they have proposed this approach then applied it as "BORA-Release" which was intended for qualitative and quantitative risk analysis of hydrocarbon releases to prevent releases on offshore oil and gas production platforms. In these papers, the expert judgment is made using one expert who is considered as reliable while it is not sufficient to account on one expert to judge these situations.

In this paper, we will focus our contribution in the use of expert judgment aggregation in the framework of BORA approach in order to make reliable decision on Safety Barriers Performance, in particular to the adjustment of average probabilities of failure of safety barriers to revised probabilities of failure using aggregation experts knowledge when assigning weights (W_i) and scores (Q_i) of RIFs. In fact, when the judgments of multiple experts are elicited, mathematical aggregation methods can then be used to combine these individual judgments into a single judgment for calculating the PFD_{rev} . Finally, the proposed methodology is applied to case study on an operational process, a combustible gas balloon (G01-VN-45-01) within the unit of gas treatment (UTGA), Sonatrach, Algeria).

Keywords

Risk analysis, BORA, Expert Judgments, BORA Approach, Safety Barriers Performance.

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