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Developing a new alternative risk assessment framework in the work sites by including a stochastic and a deterministic process: A case study for the Greek Public Electric Power Provider

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Abstract

An individual method cannot achieve the optimum risk-assessment result in the worksites, and future perspectives should focus on the parallel application of a deterministic approach with a stochastic approach. In particular, the risk analysis and assessment techniques of the deterministic (DET) approach are classified into three main categories: (a) the qualitative, (b) the quantitative, and (c) the hybrid techniques (qualitative – quantitative, semi-quantitative). Furthermore, the stochastic (STO) approach includes the classic statistical approach (CSA) and the accident forecasting modeling (AFM). The objective of this paper is triple: (a) the presentation and classification of the main risk analysis and risk assessment methods and techniques of the deterministic approach and the stochastic approach as well, (b) the development and presentation of a new alternative risk assessment framework (called as STODET) including a stochastic and a deterministic process, and (c) the application of STODET in the Greek Public Power Corporation (PPC) by using occupational accidents that have been recorded, during the 17-year period of 1993 – 2009. In particular, the STODET application proves that required actions (or suppressive measures) are essential and must be taken in a medium-term period (1 working year) for abolishing the hazard sources.

Highlights

► Presentation of the main deterministic and stochastic risk-assessment methods. ► Development of a new stochastic & deterministic (STODET) risk assessment framework. ► Application of STODET in an Electric Power Industry using occupational accidents.

Keywords

Risk management; Risk analysis; Risk assessment; Risk estimation; Quantified risk evaluation; Occupational accidents; Quantitative risk assessment techniques; Qualitative techniques; Hybrid techniques; Deterministic approach; Stochastic approach; Classic statistical approach; Accident forecasting models

Figures and tables from this article:

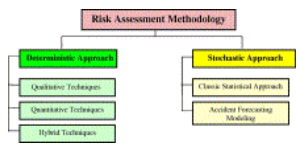

Fig. 1. The classification of the risk assessment methodologies.

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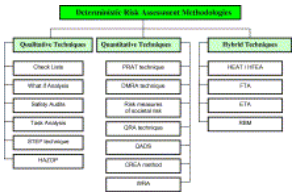

Fig. 2. It is presented the classification of the main risk analysis and assessment methodologies according to the deterministic approach.

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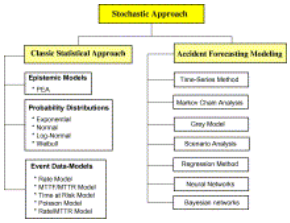

Fig. 3. It is presented the classification of the main risk analysis and assessment methodologies according to the stochastic approach.

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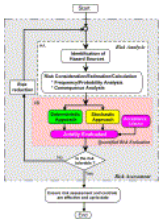

Fig. 4. The flowchart of an alternative risk assessment framework by including a stochastic and a deterministic approach (STODET), as a part of the risk management process, based on safety aspects ... guidelines of , , , , , and . The colored module #B emphasizes the application of STODET quantified risk-evaluation, which is implemented by the combination and the jointly evaluation of a stochastic and a deterministic process. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Figure options

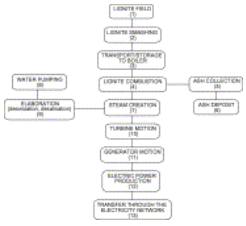

Fig. 5. The figure illustrate the process outline of electricity production in each steam power unit of Amyndaio ... Filota PPC plant in a flow chart.

Figure options

Table 1. Gradation of the risk value in association with the urgency level of required actions, according to the work of Marhavilas and Koulouriotis (2012).

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Table 2. Classification of the most important hazard sources in association with the number of accidents (or undesirable

events) and the frequency of occurrence, which have been defined in PPC, concerning the 17-year period of 1993 – 2009 (and).

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Table 3. Depiction of the annual risk-value *R* (column-group B) and its maximum value R_{max} (col. D), which have been calculated by applying the PRAT technique on the most important hazard sources defined in PPC ' s OHSS (col. A), concerning the period of 1993 – 2009. Moreover, it is illustrated the probability of failure *Q* of PPC ' s OHSS system by applying the " Time at Risk Failure " stochastic model, and using the total accidents (col. C) and the corresponding MTBF (col. E), for exposure-times of 1 working week (col. F), 1 working month (col. G) and 1 working year (col. H) respectively.

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