

USE OF RELIABILITY ENGINEERING TOOLS IN SAFETY AND RISK ASSESSMENT OF NUCLEAR FACILITIES

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ABSTRACT

Safety, reliability and availability are fundamental criteria in design, construction and operation of nuclear facilities, as nuclear power plants. Deterministic and probabilistic risk assessments of such facilities are required by regulatory authorities in order to meet licensing regulations, contributing to assure safety, as well as reduce costs and environmental impacts. Probabilistic Risk Assessment has become an important part of licensing requirements of the nuclear power plants in Brazil and in the world. Risk can be defined as a qualitative and/or quantitative assessment of accident sequence frequencies (or probabilities) and their consequences. Risk management is a systematic application of management policies, procedures and practices to identify, analyze, plan, implement, control, communicate and document risks. Several tools and computer codes must be combined, in order to estimate both probabilities and consequences of accidents. Event Tree Analysis (ETA), Fault Tree Analysis (FTA), Reliability Block Diagrams (RBD), and Markov models are examples of evaluation tools that can support the safety and risk assessment for analyzing process systems, identifying potential accidents, and estimating consequences. Because of complexity of such analyzes, specialized computer codes are required, such as the reliability engineering software develop by Reliasoft[®] Corporation, BlockSim (FTA, RBD and Markov models), RENO (ETA and consequence assessment), Weibull++ (life data and uncertainty analysis), and Xfmea (qualitative risk assessment) are some codes that can be highlighted. This work describes an integrated approach using these tools and software to carry out reliability, safety, and risk assessment of nuclear facilities, as well as, and application example.

1. INTRODUCTION

Improvements on safety, reliability and availability contribute to safe design and operation of nuclear facilities, such Nuclear Power Plants (NPPs). A plant operated with good procedures provides safety, which can be defined as eliminating those conditions that can cause death, injury, occupational illness or damage to or loss of equipment or property, to an acceptable level of risk. Deterministic and probabilistic risk assessments of such facilities are required by regulatory authorities in order to meet licensing regulations, contributing to assure safety, as well as reduce costs and environmental impacts. Probabilistic Risk Assessment (sometimes named Probabilistic Safety Analysis) has become an important part of licensing requirements of the nuclear power plants in Brazil and in the world [1].

The term safety includes hazard identification, technical evaluation, and the design of new engineering features to prevent loss. Accident prevention using appropriate technologies

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