

Development of Independent Regulator's Level-1 PSA Model by TSO to Support Regulatory Oversight

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Independent Regulator's Level-1 PSA Model for 300 MWe Pressurized Water Reactor (PWR) has been developed by the Technical Support Organization (TSO) of Pakistan Nuclear Regulatory Authority (PNRA) to support regulatory oversight process. PSA model development project was initiated by the regulatory body as a tool for ensuring safety of the nuclear power plant in relation to potential initiating events caused by random component failure and human errors. The PSA model provided many useful insights into plant systems and components including an independent assessment of the probabilities of occurrence of core damage state caused by various initiating events and adequacy of plant emergency procedures. PSA model development was started with the identification and selection of initiating events followed by initiating event grouping. Success criteria were developed for each front line safety system and all corresponding support systems. Comprehensive dependency analysis was performed to incorporate functional, physical, human interaction and component failure dependencies. Small event tree and large fault tree methodology was adopted for accident sequence modeling. Quality assurance program (QAP) and task specific procedures were developed to maintain high quality and consistency in the project. Standardized Plant Analysis Risk –Human Reliability Analysis (SPAR-H) method was used to calculate human error probabilities. Risk Spectrum Professional computer code was used for event tree and fault tree development and quantification of accident sequences. Resources required for the successful completion of the project, i.e., adequate and dedicated manpower, appropriate training, equipment and tools were provided to the PSA model development team. PSA team was also deputed for some time to NPP site to obtain necessary plant familiarization of important safety systems. Safety Assessment Section and Technical Cooperation departments of IAEA provided assistance for technical guidance and review of the PSA model. This paper describes the technical and administrative measures taken for successful completion of the project, challenges faced during the execution and lessons learnt. Results and insights obtained from PSA model development will be used in future applications for the regulatory oversight of NPPs.

Country or International Organisation

PNRA

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