

Virtual Process Hazard Analysis (Pha) Of a Nuclear Power Plant (Npp) Using Failure Mode and Effects Analysis (Fmea) Technique

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Abstract : The electricity demand is still increasing, and currently, the Philippine government is investigating the feasibility of operating the Bataan Nuclear Power Plant (BNPP) to address the country's energy problem. However, the lack of process safety studies on BNPP focused on the effects of hazardous substances on the integrity of the structure, equipment, and other components, have made the plant operationalization questionable to the public. The three major nuclear power plant incidents - TMI-2, Chernobyl, and Fukushima - have made many people hesitant to include nuclear energy in the energy matrix. This study focused on the safety evaluation of possible operations of a nuclear power plant installed with a Pressurized Water Reactor (PWR), which is similar to BNPP. Failure Mode and Effects Analysis (FMEA) is one of the Process Hazard Analysis (PHA) techniques used for the identification of equipment failure modes and minimizing its consequences. Using the FMEA technique, this study was able to recognize 116 different failure modes in total. Upon computation and ranking of the risk priority number (RPN) and criticality rating (CR), it showed that failure of the reactor coolant pump due to earthquakes is the most critical failure mode. This hazard scenario could lead to a nuclear meltdown and radioactive release, as identified by the FMEA team. Safeguards and recommended risk reduction strategies to lower the RPN and CR were identified such that the effects are minimized, the likelihood of occurrence is reduced, and failure detection is improved.

Keywords : PHA, FMEA, nuclear power plant, bataan nuclear power plant

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