

عنوان مقاله:

Creep Rupture Analysis for Major RCS Components in Station Blackout Severe Accident; A Level-2 PRA Study

محل انتشار:

چهارمین کنفرانس بین المللی مهندسی قابلیت اطمینان (سال: 1395)

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خلاصه مقاله:

Level-2 probabilistic risk assessment (PRA) deals with quantification of the large release frequency of radioactive material from a nuclear power plant in the case of hypothetical severe accidents. In this process, event trees deal with phenomenological events, such as a failure in containment in response to a severe accident load. During station blackout (SBO) severe accident in a pressurized water reactor (PWR), circulation of hot gases through the major reactor coolant system (RCS) components (i.e. hot leg, surge line, and SG tubes) creates harsh environment in terms of both high pressure and temperature after the core melting. These conditions can impose significant stress to the structural materials of these components and may eventually result in a creep rupture of one of those components. The consequences of this accident scenario are very sensitive to whether steam generator tubes fail prior to the failure of the hot leg or surge line. The significance of this scenario in PRA level-2 studies is that one should find out whether the containment is bypassed (induced SGTR; which represents a direct path radioactive materials to the environment), the melt is ejected at high pressure (no creep rupture) or at low pressure (hot-leg or surge line creep rupture). Herein, MELCOR 1.8.6 severe accident code serves as the main calculation tool. MELCOR results in this study show that the SG creep rupture would occur prior to the hot leg or surge line rupture in full loop circulation (loop seal clearance). If residual water present in the crossover legs, hot leg integrity is threatened by creep rupture, before surge line or steam generator tubes. In addition it will investigate damage function for representation of the creep rupture and failure time of major RCS components in TMLB sequence of SBO accident for a typical 2-loop PWR.

کلمات کلیدی:

Creep rupture, severe accident, station blackout, PRA level-2

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