

EFFECTS OF TUBE RUPTURE MODELING AND PARAMETERS ON ANALYSIS OF MSGTR EVENT PROGRESSION IN PWR

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A multiple steam generator tube rupture (MSGTR) event has never occurred in the commercial operation of nuclear reactors while single steam generator tube rupture (SGTR) event is reported to occur every two years. As there is no occurrence of MSGTR event, the understandings of transients and consequences of this event are very limited. In this study, a postulated MSGTR event in Korea Next Generation Reactor (KNGR) is analyzed using thermal-hydraulic system code. The KNGR is a two-loop, 3893 MWt, PWR supposed to be built in 2010. RELAP5/MOD3 is used in this study. The present study aims to understand the effects of rupture location in u-tubes, and selection of affected steam generator following a MSGTR event. In addition, it is intended to understand how tube modeling affects the results. A model of single tube with a valve is used in traditional single SGTR analysis. That is, a single tube is modeled such that the tube allows design flow rate and a valve is modeled in order for rupture simulation. However, it is obvious that there is a discrepancy in upstream conditions between broken tubes and intact tubes in reality. This discrepancy can be taken into account if a ruptured tube is separately modeled from intact tubes. To understand how these two tube modeling methods affect the analysis results is another objective of the present study.

The effects of five tube rupture locations are compared with each other. The comparison shows that the response of KNGR is to allow shortest time for operator action following a tubes rupture in the vicinity of hot-leg side tube sheet and to allow longest time following a tube ruptures at the tube top. The MSSV lift time for rupture at tube-top is evaluated as 24.5% larger than that for rupture at hot-leg side tube sheet. Also, the MSSV lift time for four cases are compared in order to examine how long operator response time is allowed depending on which steam generator is affected. The comparison shows that the cases for both of two steam generators are affected allow longer time for operator action compared with the cases that a single steam generator is affected. Further more, the tube ruptures in the steam generator where a pressurizer is linked leads to the shortest operator response time. The effects of separate tubes modeling and discharge coefficient on leak flow rate as well as MSSV lift time are under investigation now. These results will be presented in the full paper as well.

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