Div.06 - 44

Abstract Transactions, **SMiRT-24**
BEXCO/Centum Hotel, Busan, Korea - August 20-25, 2017

Analysis of whipping phenomena of a steam pipe in a nuclear power plant

Lorenzo Campinoti[1], Rosa Lo Frano[2], Eugenio Rivara[3] and Donato Aquaro [4]

[1] MSc student, DICI- University of Pisa, ITALY
[2] Researcher, DICI- University of Pisa, ITALY
[3] Design Engineer, Ansaldo Nucleare, ITALY
[4] Full Professor, DICI- University of Pisa, ITALY

Abstract

The paper deals with the problem of enhancing the protection of NPP components and equipment against the effect of a high energy piping break (e.g. large diameter piping conveying high pressure, high temperature feed-water or steam), which results in a pipe whip.

These pipes can be highly stressed and under certain extraordinary circumstances, such as the design basis earthquake, can break. In the light of that, it is obvious that a pipe whip restraint, suitably designed, would constraint the high energy lines and protect safety related systems of a NPP by preventing (or minimizing) anticipated rupture and whipping phenomena. In addition, , the piping dynamic response displacement to a break could be very large, jeopardizing adjacent structures, piping, etc.

Even if in the past pipe whipping was investigated by several research programs, a methodology capable to predict the structural integrity of structures using an explicit dynamic solver was.

This study is thus aimed at investigating the pipe whip phenomenon and the design U-shaped restraint, by means of LS DYNA code. In particular the dynamic effects associated with the postulated rupture of piping, such as the dynamic motion of pipe, the impact and smashing of a pipe onto U-shaped restraint, and the force resulting from the escaping fluid (jet impingement or blow-down force) have been investigated.

Results would provide useful information about the capacity of piping system to safely withstand whipping phenomena.