**RELAY CHATTER IN SEISMIC PRAs**

Andrea Maioli, Clarence Worrell

*Westinghouse Electric Company, LLC, 1000 Westinghouse drive Cranberry Township, PA, 16066, United States of America,* *maiolia@westinghouse.com**,* *worrelcl@westinghouse.com*

David Gerlits, Steven Satter

*Westinghouse Electric Company, LLC, Windsor, CT*

Andrew Masiunas, Mark Etre

*Stevenson & Associates*

Relay chatter is one of the most characteristic impacts that is modeled in a Seismic Probabilistic Risk Assessment (S-PRAs) and is being observed as a significant risk contributor in a number of recent S-PRAs. The primary effect of relay chatter is the spurious actuation of components or the locking and sealing of an actuation relay into an unwanted position, thus preventing the correct actuation of components. The assessment of relay chatter represents a significant effort in the development of a S-PRA due to the sheer number of devices that can chatter which are directly or indirectly modeled in the logic model and is not completely addressed by previous relays evaluation (for example through the ASI-46 programs that was developed at a number of sites. This paper discusses some of the assumptions, modeling approach covering initiating events and mitigation strategies and challenges encountered in addressing the effect of a seismic event on relays in a nuclear power plants. The discussion covers topics such as the definition of the scope of the analysis (i.e., which relays and which devices to be addressed), challenges associated with relays identification, the necessary steps associated with screening (functional vs. seismic screening) to maintain the model solvable, modeling techniques including considerations on correlation between different relays, and considerations associated with fragility analysis on both the demand side, dealing with generic versus cabinet specific amplification factors) and capacity. A critical input to the relay chatter evaluation in support to a seismic PRA is the availability of information from previous studies, which make a single approach unpractical for all plants. This paper is based on five seismic PRAs at five different utilities, which have been developed by the authors, and therefore provide a somewhat representative landscape of possible combinations. Some lessons learned regarding the plant accident sequences that involve relay chatter are also provided.