

# Use of Expert Judgment to Support Human Reliability Analysis of Implementing FLEX Equipment

**Michelle Kichline, Jing Xing, John Hughey, and Mathew Hamberstone**  
U.S. Nuclear Regulatory Commission, Washington DC, USA

**Presentation Only:** Implementation of Flexible Mitigation Strategies (FLEX) following the accident at Fukushima Dai-ichi resulted in the purchase of portable equipment (including diesel generators and diesel driven pumps) that was specifically intended to support plant shutdown after extreme external events. However, much of the equipment may also be used as added defense-in-depth to mitigate the consequences of non-FLEX-designed accident scenarios (involving anticipated internal initiating events) where installed plant equipment fails. Many nuclear power plants have considered using FLEX equipment during non-FLEX-designed accident scenarios and are taking credit for the additional equipment and mitigation strategies in their probabilistic risk analysis. The U.S. Nuclear Regulatory Commission (NRC) needs an HRA method capable of quantifying human error probabilities (HEPs) of FLEX types of actions (such as transportation, placement, connection, or local control of portable equipment) in order to support risk-informed license amendment requests, notice of enforcement discretion evaluations, event evaluations, and significance determination process evaluations. The NRC staff performed a formal expert elicitation with the purpose of using expert judgment to support the development of an HRA tool that can be used to quantify the HEPs associated with the use of FLEX equipment. The objectives of the expert elicitation are to 1) identify the unique performance shaping factors associated with FLEX strategies, 2) evaluate the contribution of these performance shaping factors on the HEPs, and 3) quantify the HEPs associated with a few typical strategies for using FLEX equipment for added defense in depth during non-FLEX-designed accident scenarios and during FLEX-designed type scenarios. The expert elicitation employed a structured process following the NRC's guidance document. The expert panel consisted of six experts with expertise in HRA, implementation of FLEX strategies, and typical maintenance practices in nuclear power plants. This presentation will describe the technical problems and results of the expert judgment as well as the implications on HRA tool development.