U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

NRC's Feedback on NEI's Draft White Paper Entitled "Guidance for Assessing Open Phase Condition Implementation Using Risk Insights"

March 20, 2019

Feedback on draft White Paper

- What is the benefit of removing the trip function for plants that have implemented the VII with protection features? Slide 5 provides NRC understanding of the OPC implementation status. How many plants are planning to remove protective features?
- Explain why the white paper did not provide numbers for the increase in risk due to spurious actuations. Are there any spurious actuation events recorded after the OPIS was fully functional (monitoring period is completed) ?
- In manual alarm response mode, all electrical loads are assumed to be recoverable given actuation of protective relaying. How is this assumption verified by electrical system analysis and/or tests? Explain why manual actions are adequate for maintaining safety functions of electric power systems during anticipated operational occurrences and accidents.
- Provide an explanation for why all of the events on slide 7 were not included in the initiating event frequency calculation.

Feedback on draft White Paper (continued)

- Explain the differences in the upper and lower OPIS monitoring failure rates (i.e., upper limit is stated as 3E-3, then later as 1E-2. Lower limit is stated as 1E-4, later as 1E-5). Also, explain the basis for the limits considering that there are at least four different OPIS designs.

- Numbers with IE frequency should be corrected (i.e., 7.5 events should probably be 7, 1.45E-3 should be 2.73E-3, and "2.00E -03 per reactor-year" verus"2.73E -03 per reactor-year).

- Existing degraded voltage protection provides a precedent in that it requires automatic protective features because of single failures and common cause failures. How does the current proposal differ?

Feedback on draft White Paper (continued)

- In the table on page 5, it would be helpful to include which plant configurations need the qualitative method, which ones need the semi-quantitative method, and which need the quantitative method.
- Explain whether the term "*open-phase*" means one or two open phases.
- May want to consider providing guidance in areas such as:
  - Whether overcurrent protection is required to protect the bus load if OPIS fails or manual operator action only is credited
  - Sensitivity analysis to account for scenarios involving unusual power configurations
  - How the modeling of parameters such as transformers and loads could affect the OPIS trip logic

Path Forward

- Revised VII
- Verification/ Inspections
- Recommendation to Commission
- Bulletin closeout

NRC Understanding of Status of Implementation of OPC Plant Modifications

- Operating Reactors – 98

  - **Modifications Completed – 73 units (NEI)**
    – 16 units (Others)

  - **Scheduled for completion in 2019 – 5 units**

  - **No modifications required – 4 units (STP and Seabrook)**

NRC Understanding of Operating Experience

- **Thirteen operating events (2001-2015)****
  - Failure of insulators and switchyard connections
  - Malfunction of breakers

❖ **South Texas Project Unit 2, US – March 1, 2001**

❖ **Koeberg, South Africa – November 11, 2005**

❖ **Fitzpatrick/and Nine Mile Point, US – December 19, 2005**

❖ **Vandellos, Spain – August 9, 2006**

❖ **Dungeness A, UK – May 14, 2007**

❖ **Beaver Valley, Unit 1, US – November 1, 2007**

❖ **Byron Station, Unit 2 – January 30, 2012**

❖ **Byron Station, Unit 1 – February 28, 2012**

❖ **Bruce Power, Unit 1, Canada – December 22, 2012**

❖ **Forsmark, Unit 3, Sweden – May 30, 2013**

❖ **Dungeness B, UK - April 2014**

❖ **Oconee Nuclear Station, Units 1 and 3 – December 2015**

**** Prior events not identified as OPCs - Monticello (LER 87-014); Nine Mile Unit 1 (LER -90-0023); and Comanche Peak Unit 1 (92-016-00**