RIC 2014

Loss of Safety Functions–Undetected Open Phase(s) in Balanced Three-Phase Offsite Power System

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Discussion Points

- Open Phase Issue – Safety Significance
- Operating Events
- NRC Actions
- NRC Requirements
- Staff Recommendations
- Bulletin 2012-01 Closure

Open Phase issue - Safety Significance

- Loss of safety functions of Engineered Safety Features
  - Both offsite and onsite electric power systems were not able to perform their intended safety functions due to the design vulnerability
  - A design-basis event concurrent with this open phase condition could likely result in exceeding the requirements contained in Title 10 of the Code of Federal Regulations (10 CFR) 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors"
  - ASP Review* – CCDP = 1×10^{-4}

*SECY-13-0107 Agencywide Documents Access and Management System Accession No. ML13232A062

Operating Events

- South Texas Project Unit 2 – March 1, 2001
- Fitzpatrick/Nine Mile – December 19, 2005
- Beaver Valley Unit 1 – November 1, 2007
- Byron Unit 2 – January 30, 2012
- Byron Unit 1 – February 28, 2012
- Bruce Power Unit 1– December 22, 2012
- Forsmark Unit 3 – May 30, 2013

NRC ACTIONS

- Byron Open Phase Event - NRC Performed Special Inspection[1]
- Information Notice 2012-03[2]
- Bulletin 2012-01: Design Vulnerability in Electric Power System[3]
- Summary Report - Documented the review of licensee responses and staff recommendations[4]
- Staff recommended regulatory action to address the open phase issue[4]

1. Agencywide Documents Access and Management System (ADAMS) Accession No. ML12087A213
2. ADAMS Accession No. ML120480170
3. ADAMS Accession No. ML12074A115
4. ADAMS Accession No. ML13052A711

NRC ACTIONS (continued)

- Requested Additional Information from Licensees
  - interim corrective actions and compensatory measures
  - the status of long-term corrective actions
- Public meetings with the industry
- Staff support for the development of industry initiatives in resolving the open-phase issue

NRC REQUIREMENTS

- General Design Criterion (GDC) 17, "Electric Power Systems," or the applicable principal design criteria in the updated final safety analysis report
- The design criteria for protection systems under 10 CFR 50.55a(h)(2) or 10 CFR 50.55a(h)(3)
- Technical Specifications requirements under 10 CFR 50.36(c)(2) and (3)

Staff Recommendations (continued)

The following two open phase conditions must be considered under all operating electrical system configurations and loading conditions

- loss of one of the three phases of the offsite power circuit on the high voltage side of a transformer connecting a GDC-17 offsite power circuit to the transmission system
  - with a high impedance ground fault condition, and
  - without a high impedance ground fault condition;
- loss of two of the three phases of the offsite power circuit on the high voltage side of a transformer connecting a GDC-17 offsite power circuit to the transmission system

Staff Recommendations

- Operating nuclear power plant licensees and new reactor licensees, combined license (COL) applicants and design centers for active safety features
  - If the open phase condition prevents the functioning of important-to-safety structures, systems, and components (SSCs), then the licensee/applicant must install plant modifications
    - automatically detect, alarm, and isolate from the open phase condition and transfer the engineered safeguard buses to an alternate power source automatically
- New reactor licensees, COL applicants, and design centers for passive safety features
  - If the open phase condition prevents the functioning of important-to-safety SSCs, then these licensees and applicants must install plant modifications to automatically detect and alarm in the main control room

Regulatory Action

- Regulatory Considerations
  - industry response and initiatives to address the open phase issue
  - interim actions taken by licensees to address the safety concerns
  - prompt corrective actions to address the design vulnerability

Bulletin Closure

- The licensees' final corrective actions may be subjected to inspections
- The Bulletin resolution/closeout actions for each plant will be publicly available