March 18, 2013

MEMORANDUM TO: Roy K. Mathew, Acting Chief
Electrical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Sergiu Basturescu, Electrical Engineer ***/RA/***
Electrical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF FEBRUARY 28, 2013, PUBLIC MEETING ON BULLETIN 2012-01, "DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM."

On February 28, 2013, a Category 2 public meeting[1] was held between the U.S. Nuclear Regulatory Commission (NRC) and representatives of the Nuclear Energy Institute (NEI) and nuclear power plant industry at NRC Headquarters, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to discuss responses to questions in Bulletin 2012-01[2], "Design Vulnerability in Electric Power System" received from licensees of current operating reactors and new reactors and to obtain feedback from the industry regarding their actions to resolve the electric power system design vulnerability. The enclosure contains the list of meeting attendees.

The NRC staff presented information regarding the Bulletin responses[3]. Specifically, the staff provided an overview of the information received from the licensees, applicable regulatory requirements, summary of the requested information, staff's recommendations and conclusions as presented in NRC Summary Report (ADAMS Accession No.ML13052A711). Based on the review of licensees' responses, the staff determined that the design vulnerability exists, and recommended that NRC take further regulatory actions to require licensees to provide design features to address the design vulnerability. In addition, the staff clarified that recommendations provided in the NRC Summary Report were developed by the Electrical Engineering Branch and would be considered by the NRC for any future regulatory actions.

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1. The original meeting notice is available via the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML12222A267.
2. The Bulletin is available under ADAMS Accession No. ML12074A115
3. The NRC presentation is available under ADAMS Accession No. ML13066A765
4. The Industry presentations are available under ADAMS Accession Nos. ML13066A620, ML13066A708, ML13066A741

The industry representatives presented[4] information regarding calculations, analyses, and details on plant electrical system modeling required to detect a single-phase open circuit condition with or without a high impedance ground fault condition. The industry representatives also provided information on modifications that are being considered by some licensees to protect plant equipment from the effects of this design vulnerability. A few plants have implemented non-Class 1E micro-processor based relays in their offsite power sources and are evaluating the performance capabilities. Some plants are considering alternative approaches using existing relays to sense unbalanced voltage and current conditions observed during loss of a single-phase as a result of conductor or insulator failure.

During the meeting, an industry representative asked why the staff's recommendation to address the design vulnerability included AP 1000 reactor units since alternating current (ac) power system is nonsafety-related and is not required to mitigate design-basis accidents or to bring the plant to a safe shutdown condition. Staff clarified that the offsite power system and the onsite non-Class 1E power system provides power to the safety-related loads through the battery chargers and defense-in-depth capabilities for reactor coolant makeup and decay heat removal during normal, abnormal, and accident conditions. The staff noted that the AP1000 design/licensing bases require that the ac power system is designed such that plant auxiliaries can be powered from the grid under all modes of plant operation and that the reliable nonsafety-related offsite and onsite ac power is normally expected to be available for important plant functions. The staff did agree to hold a separate meeting with AP1000 license holders and combined license applicants, Westinghouse, and the Nuclear Energy Institute to discuss the features of the AP1000 certified design and the site-specific off-site ac power designs to discuss the potential vulnerability and to more fully understand what additional measures may be appropriate. AP1000 plants may need to consider site-specific design features to detect and respond to a single-phase open circuit condition or high impedance ground fault condition on a credited offsite power circuit to preclude the potential to disable both offsite and onsite ac power sources as a defense in depth measure.

The NRC staff acknowledged that operating experience indicated that single-phase open circuit conditions in the offsite power source can occur any time and may go undetected for an extended period of time. However, the staff noted the potential significance of an event which results in a degraded offsite power source with no actuating signal for emergency onsite power source(s) to power engineered safety features buses, as experienced at Byron nuclear plant. The staff noted that although current NRC regulations have required protection of the onsite and offsite power systems from fault conditions, single-phase open circuit conditions were not specifically considered during the licensing phase of the operating plants because this design vulnerability and the safety significance was not known to the staff until the January 2012 Byron Unit 2 event occurred.

Enclosure:
List of Attendees

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Enclosure:
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OFFICE	NRR/DE/EEEB	NRR/DE/EEEB	NRO/DNRL/EPB2/BC	NRR/DE/EEEB/BC (A)
NAME	SBasturescu	GMatharu by E-Mail	LBurkhart by E-Mail	RMathew
DATE	3/18/2013	3/14/2013	3/18/2013	3/18/2013

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LIST OF ATTENDEES
FEBRUARY 28, 2013, MEETING WITH NUCLEAR INDUSTRY, EXTERNAL STAKEHOLDERS
ON BULLETIN 2012-01, "DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM

Name	Organization
Patrick Hiland	NRC
James Andersen	NRC
Roy Mathew	NRC
G. Singh Matharu	NRC
Peter J. Kang	NRC
Sergiu S. Basturescu	NRC
Prem Sahay	NRC
Vijay Goel	NRC
Swagata Som	NRC
Evelyn Gettys	NRC
Don Habib	NRC
Nicole Coleman	NRC
Mike Eudy	NRC
Ronaldo Jenkins	NRC
Rui Li	NRC
Hafeez Izaj	NRC
Robert Daley	NRC
Mike Cheok	NRC
Manny Coman	NRC
Ngola Otto	NRC
Larry Burkhart	NRC
*Nicole Coleman	NRC
*Tania Martinez-Navaedo	NRC
Robert F. Arritt	EPRI
Gordon Clefton	NEI
Wayne Johnson	EPRI
Janna Bergman	Scientech
Scot Greenlee	Exelon
Steve Humos	TVA
Paul Gaffney	Duke/Progress
Paul Guill	Duke Energy
Paul Colaianni	Duke Energy
Justin Lane	PSEG
Ken Petroff	PSEG
Ken Fleischer	PSEG
Dave Lambent	SNC
K. Robins	Exelon
Jim Rogers	MHI/MNES
Sandhya Madan	MPR Associates
R. Roy Lyon II	SNC
Gregory P. Norris	Entergy
Tamatha Womack	TVA

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FEBRUARY 28, 2013, MEETING WITH NUCLEAR INDUSTRY, EXTERNAL STAKEHOLDERS
ON BULLETIN 2012-01, "DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM
(CONTINUED)

Joseph Frisco	PGN
*Paul Bemis	PGE
*Jim Stavely	PSEG
*Jim Stead	PSEG
*Michael P. Baldwin	Charter
*Bob Corbett	FENOC
*Tamera Ervin-Walker	Luminant
*Bob Gambrill	INPO
*Abdi Halane	OPG
*Joe Hulderman	DTE
*Steve Hutchins	Exelon
*Slav Kaminski	OPG
*Ralph Klothe	INPO
*David Kwan	OPG
*Phil Lashley	FENOC
*Jeff Lehman	OPG
*John Liu	URS
*Eric Nelson	NPPD
*Yves Nembo	PPL
*Vasant Patel	FPL
*Ken Pigg	Duke-Energy
*Shawn Simon	INPO
*Bob Stark	Constellation
*Sami Debass	Constellation
*James Stoner	Duke-Energy
*Hideki Tanaka	MNES
*Ricky Tran	Entergy
*Dave Waters	Duke-Energy
*Greg Reimers	Diablo Canyon Power
*Steve Wegner	Xcel Energy
*Steven A. Hilmes	Watts Bar
*Don Durkosh	Westinghouse
*Mark DeMaglio	Westinghouse
*Richard DeLong	Westinghouse
*Russ Nielsen	STARS
*Jim Heishman	EPRI
*Raleigh Deann	Scientech
*Timothy Lensmire	Point Beach
*Raymond Burski	FPL
*Carrie Fosaen	Xcel Energy

*Jake Strasser	Xcel Energy
*Ron Siepel	Xcel Energy
*Mark Rice	Columbia Generating Station
*James H. Flowers	SNC
*Paul R. Johnson	Entergy
*Tommy Barnett	Entergy
*Mike Mustafa	Entergy
*Hector Quinonez	Entergy
*Dennis Sitkowski	Entergy
*Leon Hector	STP
*Tim Fanguy	SCANA
*Mark Phillips	Dominion

(*) – Denotes participants via the audio conference.