

July 16, 2013

MEMORANDUM TO: Anthony J. Mendiola, Chief
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Jonathan G. Rowley, Project Manager /RA/
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF APRIL 5, 2013, CLOSED MEETING WITH THE
PRESSURIZED WATER REACTOR OWNERS GROUP TO DISCUSS
DIGITAL CARD ISSUES IN THE SOLID STATE PROTECTION
SYSTEM

On April 5, 2013, a closed meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of the Pressurized Water Reactor Owners Group (PWROG). The purpose of this meeting was for the NRC staff and PWROG representatives to discuss the development and installation of new digital cards in the solid state protection system (SSPS) in Westinghouse Electric Company (Westinghouse) designed nuclear power plants. The PWROG believed that these replacement cards could be installed without requiring a license amendment request (LAR), as allowed by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59.

Regulatory Guide 1.187, dated November 2000, "Guidance for Implementation of 10CFR50.59 Changes, Test, and Experiments," conditionally endorsed Nuclear Energy Institute (NEI) 96-07 Revision 1, "Guidance for 10CFR50.59 Evaluations." Subsequently, Regulatory Information Summary (RIS) 2002-22, "Guidance for Licensing Digital Upgrades," endorsed NEI 01-01, "Guidance for Licensing Digital Upgrades." These guidance documents describe an acceptable way for a licensee to implement the requirements of 10 CFR 50.59.

The SSPS provides the coincidence logic to produce actuation signals for operation of the reactor protection system (RPS) and the engineered safety features actuation systems (ESFAS). The original cards used discrete non-programmable logic devices (e.g., flip-flops, "and"-gates, "or"-gates, etc.) whereas the replacement cards use complex programmable logic devices (CPLDs). The new cards are loaded with a "data file" (which NEI 01-01 defines as a type of base software) that configures the CPLD logic. Section 4.3.2 of NEI 01-01 "Software Considerations," indicates that digital modifications that involve the use of software applications should be conservatively treated as an adverse effect (requiring evaluation under 10 CFR 50.59) due to the potential introduction of new failure modes (software based failures, including common cause failures (CCF)) not previously evaluated in the update final safety analysis report, especially when modifications involve redundant high risk safety systems (i.e., RPS and ESFAS). However, the possibility of software CCF (per NEI 01-01, Section 3.2.2, "Software Common Cause Failure") was originally not considered because the CPLDs were believed to not be software-based. Subsequently, an analysis was performed which identified

only three of the eight cards that processed the coincidence and actuation signals. These cards were then tested for all possible combinations of inputs; this testing was subsequently used to support the previous conclusion (i.e., that the cards could be installed without a license amendment).

The two main objectives of the meeting were: 1) to come to the same understanding of various terms and definitions (specifically, definition of software, guidance on software development tools, and guidance on testing (testability); and 2) determination as to whether the issue can be resolved generically or is it a plant-specific issue.

The NRC staff questioned the PWROG assertion that the installation of new digital cards is not a system change thus no LAR is needed for installation to occur. The NRC staff point to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Report for Nuclear Power Plants" (SRP), Chapter 7, "Instrumentation and Controls," (I&C), Branch Technical Position (BTP) No. 7-19, Revision 6, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems," which states: "Digital instrumentation and control (DI&C) systems can be vulnerable to common-cause failure (CCF) caused by ... software developed logic, which could defeat the redundancy achieved by hardware architecture." The new SSPS cards contain CPLDs which contain software developed logic and would therefore be considered to be potentially vulnerable to CCF during a LAR review. The NRC position on software developed logic was stated as early as March 31, 2009, in the Wolf Creek Generating Station main steam and feedwater isolation system license amendment (Agencywide Documents Access and Management System (ADAMS) at Accession No. ML090610317). BTP 7-19 allows an NRC technical reviewer of a LAR to eliminate consideration of software logic based CCF if the device "is sufficiently simple such that every possible combination of inputs and every possible sequence of device states are tested and all outputs are verified for every case..." However, in the Shearon Harris Nuclear Power Plant SSPS card replacement issue, it has not been demonstrated that "every possible sequence of device states" have been tested. In addition, it cannot be generally assumed that criteria used for licensing is appropriate for use during 10 CFR 50.59 evaluations.

The PWROG described the timeline and technical development of the replacement SSPS cards. This timeline included the fact that the replacement card development effort started in 2000 and that the first cards were installed before March 31, 2009. It was noted that commercial vendors were involved in the development of the "data-file" without addressing the quality software development process as described in NEI 01-01, Section 5.3.3, "Digital System Quality."

The PWROG representatives stated that it is their intention to develop a project authorization to ask the organization for funding so that the PWROG could undertake an operability determination and the 10 CFR 50.59 evaluation.

A. Mendiola

- 3 -

A list of attendees is enclosed. The proprietary PWROG presentation can be found in the ADAMS at Accession No. ML13137A139. The NRC staff prepared and handed out a presentation at the meeting. However, the presentation was not presented during the meeting. That presentation can be found in ADAMS at Accession No. ML13149A152.

Project No. 694

Enclosure:
List of Attendees

A list of attendees is enclosed. The proprietary PWROG presentation can be found in the ADAMS at Accession No. ML13137A139. The NRC staff prepared and handed out a presentation at the meeting. However, the presentation was not presented during the meeting. That presentation can be found in ADAMS at Accession No. ML13149A152.

Project No. 694

Enclosure:
List of Attendees

| | | | |
|------------------------|---------------|----------------|-------------------|
| <u>DISTRIBUTION:</u> | JRowley | NCarte | |
| PUBLIC | SArndt | RNease | EBrown |
| RidsNrrLADBaxley | RidsNrrDe | TFanelli | ABilloch |
| RidsNroOd | RidsNrrDeEicb | RidsNrrDpr | JThorp |
| RidsNrrDprPlpb | RidsResOd | RidsNrrDraApla | RidsOgcMailCenter |
| RidsAcrsAcnwMailCenter | | | |

| | | |
|--|--|--|
| <u>EXTERNAL DISTRIBUTION:</u> | | |
| andracjd@westinghouse.com | harbautd@westinghouse.com | njstring@southernco.com |
| robert.slough@luminant.com | odessgwr@westinghouse.com | stofkomj@westinghouse.com |
| skgladney@tva.gov | rajarrett@tva.gov | rherb@southernco.com |
| roger.duval@duke-energy.com | ackmanme@westinghouse.com | mgeidson@southernco.com |
| branchd@firstenergycorp.com | altemuskj@westinghouse.com | dngd@pge.com |
| egersodk@westinghouse.com | erinle@westinghouse.com | jayboardman@gmail.com |
| mark.grantham@duke-energy.com | | |

ADAMS Accession Nos.: ML13179A148; ML13179A143 (Pkg.); ML13079A415 (Notice); ML13137A139 (PWROG Presentation); ML13149A152 (NRC Presentation);

***Concurred via e-mail**

NRR-106

| | | | | | |
|---------------|------------|------------|------------|------------|------------|
| OFFICE | PLPB/PM | PLPB/LA | EICB/BC | PLPB/BC | PLPB/PM |
| NAME | JRowley | DBaxley | JThorp* | AMendiola | JRowley |
| DATE | 07/10/2013 | 07/09/2013 | 07/15/2013 | 07/15/2013 | 07/16/2013 |

OFFICIAL RECORD COPY

List of Attendees

**Closed meeting between the U.S. Nuclear Regulatory Commission (NRC) staff and
Representatives from the Pressurized Water Reactor Owners Group (PWROG)**

April 5, 2013

| Name | Organization |
|----------------------|--|
| Roger Duval | Duke Energy |
| Mark Grantham | Duke Energy |
| Dave Branch | First Energy Nuclear Operating Company |
| Rob Slough* | Luminant Power |
| Steven Arndt | NRC |
| Patrick Hiland | NRC |
| Norbert Carte | NRC |
| Theo Fanelli | NRC |
| Ian Jung | NRC |
| Terry Jackson | NRC |
| Mike Waterman | NRC |
| Araceli Billoch | NRC |
| Dinesh Taneja | NRC |
| Jack Zhao | NRC |
| John Thorp | NRC |
| Eva Brown | NRC |
| Milton Conception | NRC |
| Jonathan Rowley | NRC |
| Jasmine Gilliam* | NRC |
| Rebecca Nease* | NRC |
| Jannette Worosilo* | NRC |
| Aljandro Alen* | NRC |
| TC Su* | NRC |
| Timothy Chandler* | NRC |
| Dan Gibbons | Pacific Gas and Electric |
| Brian Thomas* | Public Service Energy Group |
| Jay Boardman | PWROG |
| Jack Stringfellow | Southern Nuclear Operating Company |
| Ray Herb | Southern Nuclear Operating Company |
| Michael Eidson | Southern Nuclear Operating Company |
| Scott Gladney | Tennessee Valley Authority |
| Ron Jarrett | Tennessee Valley Authority |
| Jim Andrachek | Westinghouse Electric Company |
| Tom Harbaugh | Westinghouse Electric Company |
| Warren Odess-Gillett | Westinghouse Electric Company |
| Mark Stofko | Westinghouse Electric Company |
| Mark Ackman | Westinghouse Electric Company |
| Ken Altemus | Westinghouse Electric Company |
| David Ebersole | Westinghouse Electric Company |
| Larry Erin | Westinghouse Electric Company |

*Participated via telephone conferencing

ENCLOSURE