

October 2, 2014

EGM 14-002

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FROM: Patricia K. Holahan, Director */RA/*
Office of Enforcement

SUBJECT: ENFORCEMENT GUIDANCE MEMORANDUM 14-002,
DISPOSITIONING WESTINGHOUSE PRESSURIZED WATER
REACTOR LICENSEE NONCOMPLIANCE WITH 10 CFR 50.59,
“CHANGES, TESTS, AND EXPERIMENTS,” FOR THE
INSTALLATION OF COMPLEX PROGRAMMABLE LOGIC
DEVICE (CPLD) BASED SOLID STATE PROTECTION SYSTEM
(SSPS) CARDS

PURPOSE:

This enforcement guidance memorandum (EGM) provides guidance on the use of enforcement discretion to disposition Westinghouse pressurized water reactor (PWR) licensee noncompliance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.59, “Changes, tests and experiments,” for plants that have installed digital complex programmable logic device (CPLD)-based circuit boards in the solid state protection system (SSPS) without meeting the requirements of 10 CFR 50.59(c)(2)(vi) and/or 10 CFR 50.59(d)(1). The SSPS circuit boards provide the coincidence logic to produce trip signals for the reactor protection system (RPS) and actuation signals for the engineered safety features actuation systems (ESFAS).

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BACKGROUND:

On August 14, 1992, the staff published in the federal register (57 FR 36680) a proposed generic communication which stated the staff position that an analog to digital replacement of a safety system is an unreviewed safety question as defined in 10 CFR 50.59. Subsequently, on July 21, 1993, the Commission issued a staff requirements memorandum regarding SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," Item II.Q, stating, "The applicant shall assess the defense-in-depth and diversity of the proposed instrumentation and control system to demonstrate that vulnerabilities to common-mode failures have been adequately addressed. In performing the assessment, the vendor or applicant shall analyze each postulated common-mode failure for each event that is evaluated in the accident analysis section of the safety analysis report (SAR) using best-estimate methods..."

Subsequently, the staff issued Generic Letter 95-02, "Use of NUMARC/EPRI Report TR-102348, 'Guideline on Licensing Digital Upgrades,' in Determining the Acceptability of Performing Analog-to-Digital Replacements under 10 CFR 50.59" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML031070081). GL 95-02 clarified that not all analog to digital replacements required a license amendment request (LAR).

10 CFR 50.59 (1998) "A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question (i) ... or (ii) if a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; or (iii) ..."

On October 4, 1999, the U.S. Nuclear Regulatory Commission (NRC) amended 10 CFR 50.59 (64 FR 53582). Subsequently, Regulatory Guide (RG) 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," (ADAMS Accession No. ML003759710) endorsed Revision 1 of Nuclear Energy Institute (NEI)-96-07, "Guidelines for 10 CFR 50.59 Evaluations," dated November 2000 (ADAMS Accession No. ML003771157), as providing methods that are acceptable to the NRC staff for complying with the provisions of the amended rule. Item No. (ii) of the old rule became Item Nos. (v) and (vi) of the new rule.

10 CFR 50.59 (2000) "(v) Create a possibility for an accident of a different type than any previously evaluated in the final safety analysis report (as updated);

(vi) Create a possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the final safety analysis report (as updated);"

In NRC Regulatory Issue Summary 2002-22 (RIS 2002-22), "Use of EPRI/NEI Joint Task Force Report, 'Guideline on Licensing Digital Upgrades: EPRI TR-102348, Revision 1, NEI 01-01: A Revision of EPRI TR-102348 to Reflect Changes to the 10 CFR 50.59 rule,'" (ADAMS Accession No. ML023160044) the NRC staff provided its evaluation and endorsement of the subject EPRI/NEI report ("Guideline on Licensing Digital Upgrades: EPRI TR-102348, Revision 1, NEI 01-01: A Revision of EPRI TR-102348 to Reflect Changes to the 10 CFR 50.59 Rule," ADAMS Accession No. ML020860169) for use as guidance in designing and implementing digital upgrades to instrumentation and control systems. The staff's evaluation was based on

the guidance provided in U.S. NRC Standard Review Plan, NUREG-0800, Chapter 7, "Instrumentation and Controls," Revision 4, dated June 1997 (ADAMS Accession No. ML052500463), and on experience gained from the three digital system platforms the NRC reviewed and generically qualified for use in safety applications in nuclear power plants, at that point in time.

In April of 2002, the Pressurized Water Reactor Owners Group (PWROG) funded a project to develop new SSPS circuit boards that could be replaced without obtaining a license amendment under 10 CFR 50.59. In March of 2007, the CPLD designs were completed by Westinghouse and the first boards were installed before March 31, 2009. The Westinghouse summary reports for each board contained an appendix addressing 10 CFR 50.59. The 10 CFR 50.59 information in the summary reports was used by licensees to install the new SSPS boards without obtaining a license amendment; however, upon further review, the 10 CFR 50.59 information contained in the summary reports did not contain sufficient information to address and rule out NRC concerns regarding the new SSPS boards creating the possibility for a malfunction of the RPS and/or the ESFAS with a different result than previously evaluated in the Updated Final Safety Analysis Report (UFSAR).

In 2010, the NRC issued Information Notice 2010-10 (IN 2010-10), "Implementation of a Digital Control System under 10 CFR 50.59," (ADAMS Accession No. ML100080281), to inform addressees about NRC inspection findings regarding a licensee's evaluation under 10 CFR 50.59, "Changes, Tests, and Experiments," for a plant modification that implemented a digital control system. IN 2010-10 documented that the licensee's 10 CFR 50.59 evaluation did not address software faults as a source of "common-cause" failure, even though the control system was a highly safety significant system in which certain software common-cause failures could potentially place the plant in a condition outside its design basis by causing unanalyzed abnormal operating occurrences. The licensee believed that a software common-cause failure did not need to be considered in the 10 CFR 50.59 evaluation because they interpreted the guidance in NEI 01-01, Section 4.4.6, to allow changes if the likelihood of a software common-cause failure could be justified as sufficiently low due to the quality of the software application. The licensee determined the software quality was sufficiently high to provide reasonable assurance that the likelihood of software failure was not credible, thus the digital upgrade would not require prior NRC review on the basis of software common-cause failures (CCFs). Due to the lack of clarity in NEI 01-01 (as endorsed by RIS 2002-22), the NRC used enforcement discretion and did not issue a violation to address the manner in which the licensee addressed common-cause software failures in its 10 CFR 50.59 evaluation at the time. The NRC also initiated discussions with NEI to clarify NEI 01-01.

On August 12, 2013, the NRC issued a non-cited violation (NCV) to Shearon Harris Nuclear Power Plant Unit 1 (Harris) for violating 10 CFR 50.59, "Changes, tests and experiments," for failing to obtain prior NRC approval before replacing obsolete SSPS circuit boards with Westinghouse-designed CPLD-based boards (ADAMS Accession No. ML13224A290). Specifically, in the spring of 2012, Harris failed to perform a 10 CFR 50.59 evaluation that was sufficient to demonstrate that a license amendment was not required prior to replacing the original SSPS circuit boards with CPLD-based boards. This resulted in the licensee implementing a change that created the possibility of "common-cause" software malfunction of the RPS and ESFAS with a different result not previously evaluated in the UFSAR. The Harris violation was due in part to the licensee's misinterpretation of the NEI 01-01 guidance.

During the course of the Harris inspection activities and subsequent topical report review activities, the NRC staff performed a review of the significance and the extent of condition of this noncompliance. This review determined that the frequency of a SSPS board failure was low, but the consequences varied due to installation specifics such as whether or not the CPLD-based boards were installed in a single train or both trains of the SSPS. Additionally, the extent of condition review identified that Westinghouse-designed CPLD-based boards were installed in multiple trains at multiple facilities, and that 10 CFR 50.59 evaluations may have been performed which failed to provide a basis to demonstrate that a possibility for a malfunction of a SSC important to safety with a different result was not created. Specifically, when evaluating the use of CPLD-based boards in the SSPS, licensees may have failed to recognize that the CPLD-based boards used software to control their safety functions and the human system interface (HSI) used by operations and maintenance. As a result, licensees may not have performed the engineering evaluations and analyses described in NEI 01-01 to evaluate the digital device quality and design processes, and to demonstrate that the overall plant design was adequate to cope with the possibility of software CCFs. Additionally, the development of the CPLD-based boards was outsourced to commercial vendors who used commercial software design practices and tools to design and program the CPLD boards, and the quality standards identified in Section 5.3.3, "Digital System Quality," of NEI 01-01 may not have been met.

On September 11, 2013, the NRC sent a letter to the PWROG (ADAMS Accession No. ML13254A117) providing them a voluntary opportunity to notify the NRC in writing of any specific intentions to assist in resolving this issue, including potentially developing and submitting a topical report for NRC review on the acceptability of the new digital cards for use in the SSPS. On September 20, 2013, the PWROG sent a letter to the NRC stating their intention to submit a topical report for NRC review and approval. This topical report could be used to support license amendment requests (LARs) or to develop sufficient 10 CFR 50.59 evaluations for the affected facilities.

By letter dated February 21, 2014 (ADAMS) Accession No. ML14057A282), the PWROG submitted Topical Report (TR) WCAP-17867-P, Revision 0, "Westinghouse SSPS [Solid State Protection System] Board Replacement Licensing Summary Report." The review of this topical report included desk audits of Westinghouse documentation and audits at Westinghouse facilities to examine additional documentation. The final safety evaluation approving the topical report was issued September 19, 2014 (ADAMS Accession No. ML14260A133).

Basis for Granting Enforcement Discretion

The NRC staff intends to use enforcement discretion, in conjunction with the approved topical report, which may be used to support LARs or 50.59 evaluations from the affected facilities, to resolve this 10 CFR 50.59 compliance issue. To allow implementation of specific interim actions as an alternative to full compliance with 10 CFR 50.59 for plants that have installed digital CPLD-based circuit boards in the SSPS without meeting the requirements of 10 CFR 50.59(c)(2)(vi) and/or 10 CFR 50.59(d)(1), the staff will exercise enforcement discretion described below.

As described in WCAP-7306, "Reactor Protection System Diversity in Westinghouse Pressurized Water Reactors," dated April 1969, there are diverse functions within the RPS that protect the plant if a "common mode failure (CMF)" exists within the RPS. The voting and

actuation logic for these functions are implemented in the SSPS on three types of cards (universal logic board, safeguards driver, and under voltage driver). Given the information examined to date, it is probable that only one set of functions on a particular card type could be affected by a software CCF. Therefore, even in the presence of some types of software CCFs, there would be some remaining diverse protection. In addition, the other defenses (e.g., anticipated transient without scram (ATWS) equipment and manual initiations) are not affected.

For the reactor trip functions, it has been independently shown that ATWS mitigation circuitry meets the requirements of 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," for anticipated operational occurrences, but not necessarily for a design basis accident. For many engineered safety features functions, there is sufficient time to initiate the safety functions manually and meet the regulations underlying Branch Technical Position (BTP) 7-19 to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (ADAMS Accession No. ML110550791), i.e., General Design Criterion (GDC) 22, "Protection System Independence".

As described above, for many of the SSPS protective functions there are already measures to mitigate the failure to perform automatic actuation when required. In addition, the reliability of the new design boards has been addressed by separate documents for each new circuit board. The NRC staff conducted an audit of the SSPS circuit board redesign activities on April 7-11, 2014, at the Westinghouse New Stanton, PA facility (ADAMS Accession No. ML14183B483). There the audit team examined the Mean Time Between Failure (MTBF) calculations for the each circuit board and confirmed that the calculated MTBF for the new design circuit boards is an improvement over the vintage circuit board design. Therefore, although the documentation associated with the installation of the new SSPS cards was not adequate to eliminate the possibility of a malfunction with a different result than previously evaluated (i.e., CMF/CCF of the SSPS), the documentation associated with the topical report allowed the NRC staff to determine that conditions needed to eliminate the consideration of CCF have been met (BTP-7-19). Based on the material examined to date, the staff believes this issue is of low safety significance.

After considering the general tenets of the Enforcement Policy and the safety significance of the 10 CFR 50.59 violation and the surrounding circumstances, such as the lack of clarity in the guidance documents that contributed to the inadequate 10 CFR 50.59 evaluations, enforcement discretion is warranted.

To be eligible for enforcement discretion, licensees must meet the minimum criteria established in this EGM as described below, which will ensure that the regulatory process is implemented without resulting in a safety impact to the plants. In addition, each licensee that receives the discretion must take action to come into compliance with the requirements of 10 CFR 50.59 by either: (1) submitting a LAR to resolve the issue for its plant (i.e., address any plant specific action items in the safety evaluation of the CPLD-based SSPS card topical report), which the NRC staff LAR acceptance review finds acceptable in accordance with LIC 109, "Acceptance Review Procedures" (ADAMS Accession No. ML091810088); or (2) completing a 10 CFR 50.59 evaluation sufficient to provide the basis that a LAR is not needed.

ACTIONS:

In accordance with Section 3.5, "Violations Involving Special Circumstances," of the NRC Enforcement Policy, the agency will exercise enforcement discretion and will not cite licensees for violations of 10 CFR 50.59 related to CPLD-based SSPS circuit boards if the criteria and conditions below are met. Enforcement discretion will only be granted until March 31, 2015. Enforcement discretion is appropriate because the issue has low safety significance and the existing lack of clarity in the guidance documents for the 10 CFR 50.59 evaluations of the digital upgrades to instrumentation and control systems. The NRC will exercise enforcement discretion only if the licensee demonstrates that it has met the following criteria:

1. The CPLD-based boards were installed before the date of EGM issuance;
2. The licensee entered a potential violation of 10 CFR 50.59 into their corrective action program;
3. The licensee performed an operability determination (OD) and determined the SSPS to be operable; and
4. The licensee performs a review of the topical report and determines if specific site action is needed in the form of appropriate mitigation measures.

Violations associated with this enforcement discretion do not require discussion at an enforcement panel. They do require, however, the assignment of an enforcement action tracking number, and they shall be documented in an inspection report. The cover letter to the inspection report that discusses the violation should include the following or similar language:

A violation of 10 CFR 50.59, "Changes, tests and experiments," was identified. Because the violation was identified during the discretion period in Enforcement Guidance Memorandum 14-001, and meets the criteria set forth therein for the granting of enforcement discretion, the NRC is exercising enforcement discretion in accordance with Section 3.5, "Violations Involving Special Circumstances," of the NRC Enforcement Policy and therefore, will not issue enforcement action for this violation, subject to either a license amendment request (LAR) being submitted within six months after the approval date of the PWROG topical report, or a 10 CFR 50.59 evaluation (demonstrating that an LAR is not necessary) being completed within two months after the approval date of the PWROG topical report. The final safety evaluation approving the topical report was issued September 19, 2014 (ADAMS Accession No. ML14260A133).

Enforcement discretion will only be granted until March 31, 2015. To continue receiving this enforcement discretion the affected licensee shall take action to come into conformance by either: (a) submitting a docketed LAR that the staff will accept for review (addressing any plant-specific action items) by March 31, 2015; or b) completing a 10 CFR 50.59 evaluation that provides the basis that an LAR is not needed by November 30, 2014.

For affected licensees submitting a docketed LAR, this enforcement discretion will continue to be in place until the NRC disposes a licensee's LAR. For affected licensees completing an adequate 10 CFR 50.59 evaluation, this enforcement discretion will expire upon completion of a 10 CFR 50.59 evaluation, but no later than six months following the staff's completion of the Topical Report approval.

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