



NEI 01-01

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Application of 50.59, History

- 1992: NRC Proposed Generic Letter (GL)
“The Generic Letter states the NRC staffs position that an analog to digital replacement of a safety system is an unreviewed safety question as defined in 10 CFR 50.59 and will require an NRC staff review....”

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter to inform licensees of the staffs position that the installation of digital based safety systems (1) is an unreviewed safety question, (2) will require a review by the NRC staff, and (3) cannot be performed under the 10 CFR 50.59 rule. The staff's position applies to all safety-related digital equipment that uses software and in particular, to microprocessor-based systems.”

Other Considerations at the Time

- SECY 91-292 (ADAMS Accession No. ML12222A030)
- SECY-93-087 (ADAMS Accession No. ML003708021)
- SRM to SECY-93-087 Item II.Q (ML003708056)

“...The Commission has approved the revised position as follows:

1. The applicant shall assess the defense-in-depth and diversity of the proposed [I&C] system to demonstrate that vulnerabilities to common-mode failures have been adequately addressed.

2. *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. The vendor or applicant shall demonstrate adequate diversity within the design for each of these events.”

Application of 50.59, History (continued)

- 1995: NRC Issued GL 95-02
(Endorsed EPRI TR-102348, Provided Amendment Criteria, i.e., NOT all digital modifications require a license amendment)
- 50.59 addresses Safety and Non-Safety systems:
50.59 (1998) “A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question **(i)** if the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; 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)** if the margin of safety as defined in the basis for any technical specification is reduced.”

50.59 (2000) criteria reorganized and relaxed

“A licensee shall obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:

- (i)** Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the final safety analysis report (as updated);
- (ii)** Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated);
- (iii)** Result in more than a minimal increase in the consequences of an accident previously evaluated in the final safety analysis report (as updated);
- (iv)** Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the final safety analysis report (as updated);
- (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);
- (vii)** Result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered; or
- (viii)** Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.”

50.59 Regulation Comparisons

- 50.59 (1998) “A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question (i) if the **probability** of occurrence or the **consequences** of an **accident** or **malfunction** of equipment important to safety previously evaluated in the safety analysis report may be increased; or...”
- 50.59 (2000) “A licensee shall obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:
 - (i) Result in more than a minimal increase in the **frequency** of occurrence of an **accident** previously evaluated in the final safety analysis report (as updated);
 - (ii) Result in more than a minimal increase in the **likelihood** of occurrence of a **malfunction** of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated);
 - (iii) Result in more than a minimal increase in the **consequences** of an **accident** previously evaluated in the final safety analysis report (as updated);
 - (iv) Result in more than a minimal increase in the **consequences** of a **malfunction** of an SSC important to safety previously evaluated in the final safety analysis report (as updated);...”

50.59 Regulation Comparisons

- 50.59 (1998) “A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question ...(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...”
- 50.59 (2000) “A licensee shall obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:
...
(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);
...”

50.59 Regulation Comparisons

- 50.59 (1998) “A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question ...(iii) if the margin of safety as defined in the basis for any technical specification is reduced.”
- 50.59 (2000) “A licensee shall obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would: ...
(vii) Result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered; or
(viii) Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.”

Additional Concerns with NEI 01-01

- 10 CFR 50.59 allows licensees to make changes in the design of their plants, if, in part, those changes do not result in more than a minimal increase in:
 - (i) **frequency** of occurrence of an **accident**
 - (ii) **likelihood** of occurrence of a **malfunction** of a structure
- RG 1.187 endorsed Revision 1 of NEI 96-07 as an acceptable way to implement 10 CR 50.59. When addressing these “more than a minimal increase” criteria, NEI 96-07 states:

“Although this criterion allows minimal increases, licensees must still meet applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in regulatory guides and nationally recognized industry consensus standards, e.g., the ASME B&PV Code and IEEE standards). Further, *departures from the design, fabrication, construction, testing and performance standards as outlined in the General Design Criteria (Appendix A to Part 50) are not compatible with a “no more than minimal increase” standard.*”
- The underlined quotations above are understood to mean, in part, that modification that will result in deviations from or non-conformance to certain criteria in the FSAR will require a LAR.
- How should one implement the first two 50.59 clauses if, a plant has no “digital I&C” standards listed in their FSAR?
 - It does not seem reasonable to assume that this plant can do any digital upgrade without a LAR.
 - The *Italics* quotations above are understood to mean that modification that will result in deviations from or non-conformance to the current Regulatory Guides and associated standards will require a LAR.
- A digital upgrade would not need a LAR , due to a more than a minimal increase on the probability of an accident or malfunction, so long as the “digital I&C” aspects conformed to all the “digital I&C” regulatory guides or other applicable NRC endorsed guidance.

Proposed Rule Change (ML14136A089)

10CFR50.55a(h) – IEEE 603

- Please Read the DRAFT of the Proposed Rule

“(3) Modifications and replacements of protection systems and safety systems.

Modifications to and replacements of protection systems and safety systems must meet the requirements stated in this section. If a modification or replacement changes the functionality, technology (including changes to equipment qualification characteristics), independence strategy, or diversity strategy in a protection system or safety system, then the changed or replaced components, functions, or systems must meet the requirements in IEEE Std 603-2009, subject to the conditions in paragraph (h)(4) through paragraph (h)(8). Otherwise, the changed or replaced components, functions, or systems must meet the requirements in the existing licensing basis.”

(h)(4) System Integrity

(h)(5) Independence

(h)(6) Common-cause failure criteria

(h)(7) Retaining safety function capability during maintenance bypass

(h)(8) Maintenance bypass

Proposed Rule Change (ML14136A089)

10CFR50.55a(h) – IEEE 603

“(h)(6) Common-cause failure criteria.

Plant parameters shall be maintained within acceptable limits established for each design basis event in the presence of a single common cause failure. The following requirements must be met when addressing digital system common-cause failures:

- (i) Applicants and licensees shall assess the defense-in-depth and diversity of digital safety systems to demonstrate that vulnerabilities to common-cause failures have been addressed.
- (ii) **Postulated common-cause failures** shall be evaluated to demonstrate adequate diversity within the safety system for each design basis event in the accident analysis section of the safety analysis report (SAR) using best-estimate methods. The applicant or licensee shall demonstrate adequate diversity within the design for each of the events evaluated in the accident analysis section of the SAR.
- (iii) If a postulated common-cause failure could disable a safety function, then a diverse means unlikely to be subject to the same common-cause failure shall be required to perform either the same function or a different function. The diverse or different function may be performed by a non-safety system if the system is of sufficient quality to perform the necessary function under the associated event conditions.
- (iv) A set of displays and controls located in the main control room shall be provided for manual, system-level actuation of critical safety functions and monitoring of parameters that support the safety functions. The displays and controls shall be independent and diverse from the safety computer system identified in (h)(iv)(A) and (h)(iv)(C).”

Proposed Rule Change (ML14136A089)

10CFR50.55a(h) – IEEE 603

“(h)(9) *Documentation supporting compliance.* Applicants and licensees shall develop and maintain documentation, analyses, and design details demonstrating compliance with paragraphs (h)(2) through (h)(8) of this section.”