

September 19, 2007

Mr. Biff Bradley, Director
Risk Assessment
Nuclear Energy Institute
Suite 400
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Washington, DC 20006-3708

SUBJECT: FINAL SAFETY EVALUATION FOR NUCLEAR ENERGY INSTITUTE (NEI)
TOPICAL REPORT (TR) 04-10, REVISION 1, "RISK-INFORMED TECHNICAL
SPECIFICATION INITIATIVE 5B, "RISK-INFORMED METHOD FOR CONTROL
OF SURVEILLANCE FREQUENCIES" (TAC NO. MD6111)

Dear Mr. Bradley:

By letter dated April 19, 2007, the NEI submitted TR NEI 04-10, Revision 1, "Risk-Informed Technical Specification Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies" (Agency Documents Access and Management System (ADAMS) Accession No. ML071360426), to the U.S. Nuclear Regulatory Commission (NRC) staff for review. By letter dated August 31, 2007 (ADAMS Accession No. ML072330402), an NRC draft safety evaluation (SE) regarding our approval of TR 04-10, Revision 1, was provided for your review and comments. By email to Tanya Mensah dated September 11, 2007, you stated that the NEI did not have any comments on the draft SE.

The NRC staff has found that NEI 04-10, Revision 1, is acceptable for referencing by licensees proposing to amend their Technical Specifications to establish a Surveillance Frequency Control Program, to the extent specified and under the limitations delineated in NEI 04-10, Revision 1, and in the enclosed final SE. The final SE defines the basis for NRC acceptance of NEI 04-10, Revision 1.

Our acceptance applies only to material provided in the subject NEI 04-10, Revision 1. We do not intend to repeat our review of the acceptable material described in NEI 04-10, Revision 1. When NEI 04-10, Revision 1, appears as a reference in license applications, our review will ensure that the material presented applies to the specific plant involved. License amendment requests that deviate from NEI 04-10, Revision 1, will be subject to a plant-specific review in accordance with applicable review standards.

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If future changes to the NRC's regulatory requirements affect the acceptability of NEI 04-10, Revision 1, the NEI and/or licensees referencing it will be expected to revise NEI 04-10, Revision 1, appropriately, or justify its continued applicability for subsequent referencing.

If you have any questions, please contact Tanya Mensah at 301-415-3610.

Sincerely,

/RA by MCase for/

Ho K. Nieh, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 689

Enclosure: Draft SE

cc w/encl: See next page

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*No major changes to SE input. NRR-043

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
FOR TOPICAL REPORT (TR) 04-10, REVISION 1
“RISK-INFORMED TECHNICAL SPECIFICATION INITIATIVE 5B,
RISK-INFORMED METHOD FOR CONTROL OF SURVEILLANCE FREQUENCIES”
NUCLEAR ENERGY INSTITUTE
PROJECT NO. 689

1.0 INTRODUCTION AND BACKGROUND

On April 19, 2007, the Nuclear Energy Institute (NEI) submitted NEI 04-10, Revision 1, “Risk-Informed Technical Specifications Initiative 5B, Risk-Informed Method for Control of Surveillance Frequencies” (Reference 1), for U.S. Nuclear Regulatory Commission (NRC) staff review. This document provides a risk-informed methodology to identify, assess, implement, and monitor proposed changes to frequencies of surveillance requirements (SRs) of technical specifications (TSs). NEI 04-10, Revision 1, supports industry initiative 5B of the Risk-Informed TS program. These initiatives are intended to maintain and improve safety through the incorporation of risk assessment and management techniques in TSs, while reducing unnecessary burden and making TS requirements consistent with the Commission’s other risk-informed regulatory requirements.

By letter dated September 28, 2006 (Reference 8) the NRC staff approved NEI 04-10, Revision 0 (Reference 7). NEI 04-10, Revision 0, supports relocation of the surveillance frequencies of various SRs from the TSs to a licensee-controlled document, which are controlled in accordance with the requirements of 50.59 of Title 10 of the *Code of Federal Regulations* (10 CFR). Revisions to the surveillance frequencies are then made in accordance with a new program, the Surveillance Frequency Control Program (SFCP). The Administrative Controls Section of the TSs specifies the requirements for a SFCP. The methodology described in NEI 04-10 provides a risk-informed process to support a plant expert panel assessment of proposed changes to surveillance frequencies, assuring appropriate consideration of risk insights and other deterministic factors which may impact surveillance frequencies, along with appropriate performance monitoring of changes and documentation requirements.

NEI 04-10, Revision 1, adds guidance relative to the modeling and consideration of test strategies (staggered versus sequential). The original version of the document addressed test intervals only. These changes were necessary to support implementation of Initiative 5B for plants with Improved Standard Technical Specifications. It is expected that Revision 1 of the document will be referenced in TSTF-425, Revision 1. Additional clarifying changes are proposed that were identified based on the experience of the pilot plant.

ENCLOSURE

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.36, TSs are required to include items in the following five specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation; (3) SRs; (4) design features; and (5) administrative controls. The rule does not specify the particular requirements to be included in a plant's TSs. As stated in 10 CFR 50.36(c)(3), "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met."

The SFCP shall ensure that SRs specified in the TS are performed at intervals sufficient to assure the above regulatory requirements are met. Existing regulatory requirements, such as 10 CFR 50.65 (Maintenance Rule) and 10 CFR Part 50, Appendix B (Corrective Action Program), require monitoring of surveillance test failures and implementing corrective actions to address such failures. One of these actions may be to consider increasing the frequency at which a surveillance is performed. In addition, the SFCP implementation guidance in NEI 04-10, Revision 1, requires monitoring of the performance of structures, systems, and components (SSCs) for which surveillance frequencies are decreased to assure reduced testing does not adversely impact the SSCs.

Changes to surveillance frequencies in the SFCP using NEI 04-10, Revision 1, including qualitative considerations, results of risk analyses, sensitivity studies and any bounding analyses, and recommended monitoring of SSCs, are required to be documented. These may be subject to regulatory review and oversight of the SFCP implementation.

These regulatory requirements, and the monitoring required by NEI 04-10, Revision 1, ensure that surveillance frequencies that are insufficient to assure that the requirements of 10 CFR 50.36 are satisfied will be identified and appropriate corrective actions taken.

3.0 TECHNICAL EVALUATION

The industry submitted NEI 04-10, Revision 1, which provides a risk-informed method to change surveillance frequencies. Probabilistic risk assessment (PRA) methods are used, in combination with plant performance data and other considerations, to identify and justify modifications to the surveillance frequencies of equipment at nuclear power plants. This is in accordance with guidance provided in Regulatory Guides (RGs) 1.174 and 1.177 (References 2 and 3, respectively) in support of changes to surveillance test intervals.

RG 1.177 identifies five key safety principles to be met for risk-informed changes to TS. Each of these principles is addressed by NEI 04-10, Revision 1, as discussed below.

1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption or rule change.

10 CFR 50.36(c) provides that TSs will include SRs which are "requirements relating to test, calibration, or inspection to assure that necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for

operation will be met.” NEI 04-10, Revision 1, supports relocating the surveillance frequencies from the TSs to a licensee-controlled program by providing a NRC-approved methodology for control of the surveillance frequencies. The SRs themselves would remain in the TSs, as required by 10 CFR 50.36(c).

This change is consistent with other NRC-approved TS changes in which the surveillance frequencies are relocated to licensee-controlled documents, such as surveillances performed in accordance with the In-Service Testing Program or the Primary Containment Leakage Rate Testing Program. Thus, this proposed change meets the first key safety principle of RG 1.177 by complying with current regulations.

2. The proposed change is consistent with the defense-in-depth philosophy.

Consistency with the defense-in-depth philosophy is maintained if:

- A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation.
- Over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided.
- System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties (e.g., no risk outliers). Because the scope of the proposed methodology is limited to revision of surveillance frequencies, the redundancy, independence, and diversity of plant systems are not impacted.
- Defenses against potential common cause failures (CCFs) are preserved, and the potential for the introduction of new CCF mechanisms is assessed.
- Independence of barriers is not degraded.
- Defenses against human errors are preserved.
- The intent of the General Design Criteria in 10 CFR Part 50, Appendix A, are maintained.

NEI 04-10, Revision 1, uses both the core damage frequency (CDF) and the large early release frequency (LERF) metrics to evaluate the impact of proposed changes to surveillance frequencies. Compliance with the guidance of RG 1.174 and RG 1.177 for changes to CDF and LERF is achieved by evaluation using a comprehensive risk analysis, which assesses the impact of proposed changes including contributions from human errors and CCFs. Defense-in-depth is also included in the methodology explicitly as a qualitative consideration outside of the risk analysis, as is the potential impact on detection of component degradation that could lead to increased likelihood of CCFs. Both the quantitative risk analysis and the qualitative considerations assure a reasonable balance of defense-in-depth is maintained to ensure protection of public health and safety, satisfying the second key safety principle of RG 1.177.

3. The proposed change maintains sufficient safety margins.

The design, operation, testing methods, and acceptance criteria for SSCs, specified in applicable codes and standards (or alternatives approved for use by the NRC) will continue to be met as described in the plant licensing basis (including the final safety analysis report and

bases to TS), since these are not affected by changes to the surveillance frequency. Similarly, there is no impact to safety analysis acceptance criteria as described in the plant licensing basis. Thus, safety margins are maintained by the proposed methodology, and the third key safety principle of RG 1.177 is satisfied.

4. When proposed changes result in an increase in CDF or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

RG 1.177 provides a framework for risk evaluation of proposed changes to surveillance frequencies, which requires identification of the risk contribution from impacted surveillances, determination of the risk impact from the change to the proposed surveillance frequency, and performance of sensitivity and uncertainty evaluations. NEI 04-10, Revision 1, satisfies the intent of RG 1.177 requirements for evaluation of the change in risk, and for assuring that such changes are small.

Quality of the PRA. The quality of the PRA must be compatible with the safety implications of the proposed TS change and the role the PRA plays in justifying the change. The NRC has developed regulatory guidance to address PRA technical adequacy, RG 1.200 (Reference 4), which addresses the use of the American Society of Mechanical Engineers (ASME) RA-Sa-2003, Addenda to ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications (Reference 5), and the NEI peer review process NEI 00-02, "PRA Peer Review Process Guidance" (Reference 6). NEI 04-10, Revision 1, requires an assessment of the PRA models used to support the SFCP against the requirements of RG 1.200 to assure that the PRA models are capable of determining the change in risk due to changes to surveillance frequencies of SSCs, using plant-specific data and models. Capability category II of ASME RA-Sa-2003 is applied as the standard, and any identified deficiencies to those requirements are assessed further in sensitivity studies to determine any impacts to proposed decreases to surveillance frequencies. This level of PRA quality, combined with the proposed sensitivity studies, is sufficient to support the evaluation of changes to surveillance frequencies within the SFCP, and is consistent with Regulatory Position 2.3.1 of RG 1.177.

Scope of the PRA. NEI 04-10, Revision 1, evaluates each proposed surveillance frequency decrease to determine its potential impact on risk, due to impacts from internal events, fires, seismic, other external events, and from shutdown conditions. Consideration is made of both CDF and LERF metrics. Where quantitative risk models are unavailable, bounding analyses or other conservative quantitative evaluations are performed. A qualitative screening analysis may be used when the surveillance frequency impact on plant risk can be shown to be negligible or zero. The guidance provided in NEI 04-10, Revision 1, is sufficient to ensure the scope of the risk contribution of each surveillance is properly identified for evaluation, and is consistent with Regulatory Position 2.3.2 of RG 1.177.

PRA Modeling. NEI 04-10, Revision 1, determines if the SSCs affected by a surveillance are modeled in the PRA. Where the SSC is directly or implicitly modeled, a quantitative evaluation of the risk impact is carried out. The methodology adjusts the

failure probability of the impacted SSCs, including any impacted CCF modes, based on the proposed change to the surveillance frequency. Where the SSC is not modeled in the PRA, bounding analyses are performed to characterize the impact of the proposed change to surveillance frequency. Potential impacts on the risk analyses due to screening criteria and truncation levels are adequately addressed by the requirements for PRA technical adequacy addressed by RG 1.200, and by sensitivity studies identified in NEI 04-10, Revision 1. Guidance is provided for the quantitative evaluation of the impact of selected testing strategy (i.e., staggered testing or sequential testing) consistent with the guidance of NUREG/CR-6141 and NUREG/CR-5497.

Therefore, the guidance provided in NEI 04-10, Revision 1, for PRA modeling is sufficient to ensure an acceptable evaluation of risk due to the change in surveillance frequency, and is consistent with Regulatory Position 2.3.3 of RG 1.177.

Assumptions. The failure probabilities of SSCs modeled in a PRA include a standby time-related contribution and a cyclic demand-related contribution. NEI 04-10, Revision 1, adjusts the time-related failure contribution of SSCs affected by the proposed change to surveillance frequency. This is consistent with RG 1.177, Section 2.3.3, which permits separation of the failure rate contributions into demand and standby for evaluation of SRs. If the available data do not support distinguishing between the time-related failures and demand failures, then the change to surveillance frequency is conservatively assumed to impact the total failure probability of the SSC, including both standby and demand contributions. The SSC failure rate (per unit time) is assumed to be unaffected by the change in test frequency, and this is confirmed by the required monitoring and feedback implemented after the change in surveillance frequency is implemented.

The process requires consideration of qualitative sources of information with regards to potential impacts of test frequency on SSC performance, including industry and plant-specific operating experience, vendor recommendations, industry standards, and code-specified test intervals. Thus, the process is not reliant upon risk analyses as the sole basis for the proposed changes.

The potential beneficial risk impacts of reduced surveillance frequency, including reduced downtime, lesser potential for restoration errors, reduction of potential for test-caused transients, and reduced test-caused wear of equipment, are identified qualitatively, but are conservatively not required to be quantitatively assessed.

Thus, NEI 04-10, Revision 1, employs reasonable assumptions with regard to extensions of surveillance test intervals, and is consistent with Regulatory Position 2.3.4 of RG 1.177.

Sensitivity and Uncertainty Analyses. NEI 04-10, Revision 1, requires sensitivity studies to assess the impact of uncertainties from key assumptions of the PRA, uncertainty in the failure probabilities of the affected SSCs, impact to the frequency of initiating events, and of any identified deviations from capability category II of ASME RA-Sa-2003. Where the sensitivity analyses identify a potential impact on the proposed change, revised surveillance frequencies are considered, along with any qualitative

considerations that may bear on the results of such sensitivity studies. Required monitoring and feedback of SSC performance once the revised surveillance frequencies are implemented are also used. Thus, NEI 04-10, Revision 1, appropriately considers the possible impact of PRA model uncertainty and sensitivity to key assumptions and model limitations, and is consistent with Regulatory Position 2.3.5 of RG 1.177.

Acceptance Guidelines. NEI 04-10, Revision 1, quantitatively evaluates the change in total risk (including internal and external events contributions) in terms of CDF and LERF for both the individual risk impact of a proposed change in surveillance frequency and the cumulative impact from all individual changes to surveillance frequencies. Each individual change to surveillance frequency must be shown to result in a risk impact below $1\text{E-}6$ per year for change to CDF, and below $1\text{E-}7$ per year for change to LERF. These are consistent with the limits of RG 1.174 for very small changes in risk. Where the RG 1.174 limits are not met, the process either considers revised surveillance frequencies which are consistent with RG 1.174, or the process terminates without permitting the proposed changes. Where quantitative results are unavailable to permit comparison to acceptance guidelines, appropriate qualitative analyses are required to demonstrate that the associated risk impact of a proposed change to surveillance frequency is negligible or zero. Otherwise, bounding quantitative analyses are required which demonstrate the risk impact is at least one order of magnitude lower than the RG 1.174 acceptance guidelines for very small changes in risk.

In addition to assessing each individual SSC surveillance frequency change, the cumulative impact of all changes must result in a risk impact below $1\text{E-}5$ per year for change to CDF, and below $1\text{E-}6$ per year for change to LERF, and the total CDF and total LERF must be reasonably shown to be less than $1\text{E-}4$ per year and $1\text{E-}5$ per year, respectively. These are consistent with the limits of RG 1.174 for acceptable changes in risk, as referenced by RG 1.177 for changes to surveillance frequencies. The NRC staff interprets this assessment of cumulative risk as a requirement to calculate the change in risk from a baseline model utilizing failure probabilities based on the surveillance frequencies prior to implementation of the SFCP, compared to a revised model with failure probabilities based on changed surveillance frequencies. The NRC staff further notes that NEI 04-10, Revision 1, includes a provision to exclude the contribution to cumulative risk from individual changes to surveillance frequencies associated with small risk increases (less than $5\text{E-}8$ CDF and $5\text{E-}9$ LERF) once the baseline PRA models are updated to include the effects of the revised surveillance frequencies.

The quantitative acceptance guidance of RG 1.174 is necessary but not sufficient to accept decreases in surveillance frequencies. The process also considers qualitative information to evaluate the proposed changes to surveillance frequencies, including industry and plant-specific operating experience, vendor recommendations, industry standards, the results of sensitivity studies, and SSC performance data and test history. The final acceptability of the proposed change is based on all of these considerations and not solely on the PRA results compared to numerical acceptance guidelines. Performance monitoring and feedback are also required to assure that lessons learned from past experience are considered.

Thus, NEI 04-10, Revision 1, provides reasonable acceptance guidelines and methods for evaluating the risk increase of proposed changes to surveillance frequencies, and is consistent with Regulatory Position 2.4 of RG 1.177.

Therefore, the proposed methodology satisfies the fourth key safety principle of RG 1.177 by assuring any increase in risk is small consistent with the intent of the Commission's Safety Goal Policy Statement.

5. The impact of the proposed change should be monitored using performance measurement strategies.

NEI 04-10, Revision 1, requires performance monitoring of SSCs whose surveillance frequency has been revised as part of a feedback process to assure that the change in test frequency has not resulted in degradation of equipment performance and operational safety. The monitoring and feedback includes consideration of Maintenance Rule monitoring of equipment performance. In the event of degradation of SSC performance, the surveillance frequency is reassessed in accordance with the methodology, in addition to any corrective actions which may apply as part of the Maintenance Rule requirements. The performance monitoring and feedback specified in NEI 04-10, Revision 1, is sufficient to reasonably assure acceptable SSC performance and is consistent with Regulatory Position 3.2 of RG 1.177. Thus, the fifth key safety principle of RG 1.177 is satisfied.

4.0 LIMITATIONS AND CONDITIONS

The NRC staff finds that the methodology in NEI 04-10, Revision 1 is acceptable for referencing by licensees proposing to amend their TSs to establish a SFCP provided the following conditions are satisfied:

1. The licensee submits documentation with regards to PRA technical adequacy consistent with the requirements of RG 1.200, Section 4.2.
2. When a licensee proposes to use PRA models for which NRC-endorsed standards do not exist, the licensee submits documentation which identifies the quality characteristics of those models, consistent with RG 1.200 Sections 1.2 and 1.3. Otherwise, the licensee identifies and justifies the methods to be applied for assessing the risk contribution for those sources of risk not addressed by PRA models.

5.0 CONCLUSION

The NRC staff has reviewed NEI 04-10, Revision 1, a risk-informed methodology using plant-specific risk insights and performance data to revise surveillance frequencies within an SFCP, allowing for licensee control of the surveillance frequencies. This methodology would support a proposed change to a licensee's TSs by relocating surveillance frequencies to a licensee-controlled document, allowing those frequencies to be revised in accordance with NEI 04-10, Revision 1, as referenced in the Administrative Controls Section of the TSs.

The NRC staff finds that the proposed implementing methodology satisfies the key principles of risk-informed decision making applied to changes to TSs as delineated in RG 1.177 and RG 1.174, in that:

- The proposed change meets current regulations;
- The proposed change is consistent with defense-in-depth philosophy;
- The proposed change maintains sufficient safety margins;
- Increases in risk resulting from the proposed change are small and consistent with the Commission's Safety Goal Policy Statement; and
- The impact of the proposed change is monitored with performance measurement strategies.

The NRC staff, therefore, finds that this methodology is acceptable for referencing by licensees proposing to amend their TS to establish a SFCP provided that the conditions in Section 4.0 of this SE are satisfied.

6.0 REFERENCES

1. NEI 04-10, "Risk-Informed Technical Specifications Initiative 5B, Risk-Informed Method for Control of Surveillance Frequencies," Revision 1, April 2007, Accession No. ML071360462.
2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," August 1998.
3. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," August 1998.
4. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.200 for Trial Use, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," February 2004.
5. ASME RA-Sa-2003, Addenda to ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, December 2003.
6. NEI 00-02, Probabilistic Risk Assessment (PRA) Peer Review Process Guidance, May 2006, Accession No. ML061510619.
7. NEI 04-10, Revision 0, "Risk-Informed Method for Control of Surveillance Frequencies within the Surveillance Frequency Control Program," July 2006, Accession No. ML062570416.
8. Letter from H. Hieh (NRC) to T. Pietrangelo (NEI), "Final Safety Evaluation For Nuclear Energy Institute (NEI) Industry Guidance Document NEI 04-10, Revision 0, Risk-Informed Technical Specifications Initiative 5B, Risk-Informed Method For Control Of Surveillance Frequencies," dated September 28, 2006, Accession No. ML062700012.

Principal Contributor: Andrew J. Howe

Date: September 19, 2007

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