September 2, 2005

STAKEHOLDERS: NUCLEAR ENERGY INSTITUTE AND OTHER INTERESTED STAKEHOLDERS

SUBJECT: SUMMARY OF AUGUST 5, 2005, PUBLIC TELECONFERENCE WITH STAKEHOLDERS TO DISCUSS ACRS COMMENTS ON THE DRAFT REVISION OF NEI 04-02, "GUIDANCE FOR IMPLEMENTING A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION PROGRAM UNDER 10 CFR 50.48(c)"

On August 5, 2005, the Nuclear Regulatory Commission (NRC) staff held a teleconference with representatives of the Nuclear Energy Institute (NEI) and other interested stakeholders identified in Attachment 1. This teleconference was intended to discuss the Advisory Committee on Reactor Safeguards' (ACRS's) comments on the draft revision of NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)" and the associated draft Regulatory Guide, DG-1139, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants." The ACRS comments were provided in their letter to Luis A. Reyes, Executive Director for Operations, dated June 14, 2005, available at Agencywide Document Access and Management System (ADAMS) Accession Number ML051680310.

This was a Category 3 Meeting. The public was invited to participate in this meeting by providing comments and asking questions throughout the meeting.

The NRC led the discussion and presented the NRC recommendations for addressing the ACRS comments on NEI 04-02 for discussion. The comments and the agreed approach to resolving the comments are described in Attachment 2.

The NRC agreed to provide final comments and input to NEI with respect to NEI 04-02 by August 12, 2005. NEI agreed to issue the final draft of the document approximately 1-1/2 weeks after receipt of the NRC input.

Persons who do not have access to ADAMS should contact the NRC Public Document Room staff at 1-800-397-4209 or 301-415-4737, or by e-mail to pdr@nrc.gov.

/RA/
Chandu P. Patel, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachments:
1. List of Attendees
2. Summary of NRC Comments/Resolutions
3. Quality of Fire Probabilistic Risk Analysis for Applications - Points for Discussion
4. NFPA [National Fire Protection Association]-805 Risk Analysis Examples

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ATTENDANCE LIST

NUCLEAR REGULATORY COMMISSION STAFF TELECONFERENCE

WITH NUCLEAR ENERGY INSTITUTE AND OTHER INTERESTED STAKEHOLDERS

August 5, 2005

NRC	EXTERNAL STAKEHOLDERS (All by Phone)
Sunil Weerakkody	Alex Marion, NEI
Dan Frumkin	Brandon Jamar, NEI
John Hannon	Dennis Henneke, Duke Power
Bob Radlinski	Jeff Ertman, Progress Energy
J. S. Hyslop	James Blum, EPM
Ray Gallucci	Kiang Zee, ERIN Engineering and Research Inc.
Greg Cameron	Jim Liming, ERIN Engineering and Research Inc
See-Meng Wong	Jim Lin, ERIN Engineering and Research Inc
John Lamb	Richard Dible, AREVA
	W. Loh, ABS Consulting
	Karl Bohlander, PNNL
	Bob Smoter, PNNL
	Deann Raleigh, Scientech

Attachment 1

SUMMARY OF NRC COMMENTS AND AGREED RESOLUTIONS

1. PRA Quality - Discussed proposed guidance forwarded to participants by NRC (Attachment 3). NRC plans to include this guidance in the regulatory guide. Guidance is applicable to all PRA methods used to assess FPP risk. **NRC requested participants to review the handout and provide comments**. The NRC staff stated that no changes are required to NEI 04-02 to address PRA quality.

2. Risk Screening - The NRC noted that plant changes that potentially increase risk may be evaluated qualitatively, where appropriate, during the current NRC phase of PRA development and implementation. However later phases may require that increased risk of a plant change be evaluated by quantitative analysis. The industry participants disagreed with this position, noting that qualitative assessments of risk are acceptable and commonly used in a risk-informed environment. Industry representatives also noted that fire risk assessment methods should be consistent with all other industry PRA applications. It was agreed that the current versions of the NFPA 805 regulatory guide and NEI 04-02 would not specifically require quantitative risk-screening analysis and tracking of ΔCDF and ΔLERF for plant changes with negligible risk increase. The Staff provided risk analysis examples for information (Attachment 4). **Specific guidance for very low risk changes will be developed from experience gained in the Pilot Program and included in future revisions of the guidance documents.**

3. Fire Model Path w/o Risk Assessment - Fire modeling sections of NEI 04-02 still include statements indicating that the fire modeling path can be used to determine the acceptability of a plant change without performing a risk evaluation. **NEI agreed to remove from NEI 04-02 any statements that would indicate that a plant change could be evaluated without a risk assessment.**

4. Role of SDP for Risk Assessments - The Fire SDP methods may be helpful in a bounding analysis of risk and the SDP tools can provide input to the PRA. But the SDP is not an acceptable process in itself to assess the acceptability of a plant change under NFPA 805. **There was agreement on this statement - it should be addressed in NEI 04-02 or the regulatory guide.**

5. Statements in NEI 04-02 that don't support the Commission's PRA policy - The ACRS commented that any such statements should be deleted from the guidance document. NEI does not believe that there are any such statements in the current version of the document. **The NRC will review NEI 04-02 to confirm that no such statements are included.**

6. Minimize Use of Subjective Terminology Without Specific Guidance - Examples include "adequate," "reasonable assurance," and "sufficiently large." **NRC will identify and provide suggested guidance to make more specific.**

7. Editorial Comments - **Staff editorial comments will be faxed to NEI by COB August 12, 2005.**

8. Actions and Due Dates - Actions are noted in bold text above. The due date for NRC input to NEI (Brandon Jamar) for inclusion in NEI 04-02 is August 12, 2005. NEI committed to issuing a draft final version of NEI 04-02 to the NRC within 1-1/2 weeks from receipt of NRC input.

QUALITY OF FIRE PRA ANALYSIS FOR APPLICATIONS

POINTS FOR DISCUSSION

RG 1.174 provides general guidance on the quality of a PRA analysis used to support an application in terms of its "appropriateness with respect to [1] scope, [2] level of detail, and [3] technical acceptability." *[RG 1.174, Section 2.2.3]* The quality of a Fire PRA (FPRA) analysis must be consistent with RG 1.174 guidance. These three aspects of a FPRA must "be commensurate with the application for which it is intended and the role the FPRA results play in the regulatory decision process . . . ." *[RG 1.174, Section 2.2.3, extended to FPRA]* that integrates risk insights with considerations of defense in depth and safety margins. While the required scope, level of detail, and technical acceptability may vary with the application, an "over-riding requirement is that the FPRA should realistically reflect the plant's actual design, construction, operational practices, and operational experience." *[RG 1.174, Section 2.2.3, extended to FPRA]*

The staff plans to use completed regulatory documents such as the RG 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, and NUREG/CR-6850, *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*, as well as applicable criteria in draft guidance documents such as RG 1.200, *An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities*, to achieve a predictable regulatory environment with respect to FPRA Quality for plants that adopt NFPA 805. The NFPA-805 pilot plant program will provide feedback that will help to enhance the guidance for use in subsequent NFPA-805 applications that employ FPRA.

With regard to scope, a FPRA application must address those plant operating modes and fire initiating events to the extent necessary to characterize the risk aspects of the application. However, while desirable (see a "fully acceptable" FPRA analysis discussed below), "it is not [always] necessary to have a FPRA of such scope that treats all operating modes and fire initiating events." [RG 1.174, Section 2.2.3.1, extended to FPRA]. Nonetheless, the analyst must understand the limitations of the particular FPRA that was performed. With respect to level of detail, failure to model the plant (or relevant portion of the plant) at the appropriate level of detail may result in calculated risk values that do not appropriately capture the risk significance of the proposed change.

In other words, the level of detail required to support a FPRA application "must be sufficient to model the impact of the proposed change. The characterization of the problem should include establishing a cause-effect relationship to identify portions of the FPRA affected by the issue being evaluated . . . . If the impacts of a change to the plant cannot be associated with elements of the FPRA, the FPRA should be modified accordingly or the impact of the change should be evaluated qualitatively as part of the integrated decision-making process . . . . In any [application], the effects of the changes on the reliability and unavailability of systems, structures, and components, [including fire protection systems and features, or on feasible and reliable operator actions for safe shutdown response], should be appropriately accounted for." *[RG 1.174, Section 2.2.3.2, extended to FPRA]*

Technical acceptability of a FPRA used for an application is "determined by the adequacy of the [PRA] modeling and the reasonableness of the assumptions and approximations. A FPRA used in [an application] should be performed correctly, in a manner that is consistent with accepted practices, commensurate with the required scope and level of detail as discussed above. [While different] approaches may be used to assess the technical acceptability of a FPRA, one approach [is] a peer review of the FPRA . . . .

"Industry FPRA certification programs and FPRA cross-comparison studies could also be used to help assess appropriate scope, level of detail, and technical acceptability of the FPRA. If such programs or studies are to be used, a description of the program, including the approach and standard or guidelines to which the FPRA is compared, the depth of the review, and the make-up and qualifications of the personnel involved should be considered as part of the review

"Based on the peer review or certification/cross-comparison process, and on the findings from this process, the licensee should justify why the FPRA is adequate for the application in terms of scope, level of detail, and technical acceptability . . . [Although a staff assessment] cannot be replaced in its entirety by a peer review or certification/cross-comparison," *[RG 1.174, Section 2.2.3.3, extended to FPRA]* the staff's assessment of the peer review and its findings, including any resolutions, should determine whether the quality of the FPRA analysis is of sufficient rigor for an application.

General Attributes of a Fully Acceptable Fire PRA Analysis for Applications

The following are four general attributes of what would be considered a fully acceptable FPRA for applications. First, the FPRA should address all fire initiating events for all modes of operation including low power and shutdown to ensure that the effect on risk from licensee-initiated changes is adequately characterized in a manner sufficient to support a technically defensible determination of the level of risk. Second, the FPRA should calculate CDF and LERF so that these measures can be compared against regulatory thresholds, such as those defined in RG 1.174. Third, the FPRA must reasonably represent the current configuration and operating practices at the plant to ensure that estimates of CDF and LERF adequately reflect the facility for which a decision must be made. Finally, the PRA should have "sufficient technical adequacy" including consideration of uncertainty, as well as a sufficient level of detail to provide confidence that the total CDF and LERF, and changes in total CDF and LERF, adequately reflect the proposed change. Uncertainty must be considered to ensure that the decision is robust and accommodates limitations of the particular FPRA that was performed.

NFPA 805 RISK ANALYSIS EXAMPLES

EXAMPLE 1. Enhancement of the Fire Protection Program That Results in an Increase in Flooding Risk

The automatic sprinkler systems in the emergency diesel generator (EDG) rooms will be expanded to provide coverage of the EDG instrument racks, one in each room. This requires that 5 ft. of piping and one sprinkler head be added to each system. While it is recognized that increasing the suppression capability will not increase (and will likely decrease) both the core damage frequency (CDF) and large early release frequency (LERF) due to fire in the EDG rooms, the additional piping and sprinkler heads will increase the potential for inadvertent sprinkler actuation, and therefore flooding, in each room. An increase in both CDF and LERF due to EDG room flooding will result.

Without attempting to quantify the potential reduction in fire CDF and LERF resulting from suppression capability enhancement, we pursue a bounding analysis for the increases in flooding CDF and LERF. If we can show that these increases, which bound the overall (if any) increases in total CDF and LERF (including any reduction in fire CDF and LERF), are inconsequential (<1E-8/yr for CDF and <1E-9/yr for LERF), we need pursue this analysis no further.

Piping and sprinkler heads are not explicitly modeled for flooding CDF and LERF. Instead, they are implicitly embedded in the flooding frequencies for the two EDG rooms, which is 0.0060/yr per room. The plant PSA indicates that each flooding initiator contributes 3.0% to the total flooding CDF and LERF, each of which contributes 5.0% to the total internal plus external events CDF and LERF, 5.0E-5/yr and 2.0E-6/yr, respectively. Thus, the baseline flooding CDF and LERF for each EDG room, i.e., given the baseline initiator frequency of 0.0060/yr, is (0.030)(0.050)(5.0E-5/yr) = 7.5E-8/yr for CDF and (0.030)(0.050)(2.0E-6/yr) = 3.0E-9/yr for LERF.

A review of generic data for leak/rupture of piping and sprinkler heads provides the following estimates.

Piping.

3.0E-9/hr-ft (leak) and 1.0E-10/hr-ft (rupture) from WSRC-TR-93-262, *Savannah River Site Generic Data Base Development*, 1993. The total leak plus rupture frequency becomes 3.1E-9/hr-ft, or 2.7E-5/yr-ft, assuming 8760 hr/yr.

Sprinkler Head.

High estimate = 6.2E-7/hr, or 0.0054/yr, assuming 8760 hr/yr (leak [due to inadvertent actuation]) from Dexter and Perkins, *Component Failure-Rate Data with Potential Applicability to a Nuclear Fuel Reprocessing Plant*, Savannah River Laboratory, 1982. Low estimate = 1.6E-6/yr (leak), from 12/19/77 Factory Mutual Research letter from M. Miller to N. Alvarez at Lawrence Livermore National Laboratory (LLNL), as reported in S. Brereton, et al., *Atomic Vapor Laser Isotope Separation Criticality Risk*

Assessment, LLNL, 1998. A reasonable estimate of the leak rate would be the geometric mean of the high and low values, or 9.3E-5/yr.

For each EDG room, the increase in flooding frequency would be the sum of the contributions from the additional 25 ft of piping and one sprinkler head, i.e., (5 ft)(2.7E-5/yr-ft) + 9.3E-5/yr = 2.3E-4/yr. Since the baseline CDF and LERF due to flooding in each EDG room are proportional to the baseline flooding frequency, the potential increases in flooding CDF and LERF per EDG room are as follows: (2.3E-4/yr)/(0.0060/yr) * (7.5E-8/yr) = 2.9E-9/yr for CDF and (2.3E-4/yr)/(0.0060/yr) * (3.0E-9/yr) = 1.1E-10/yr for LERF. Since both EDG rooms contribute, the total increases in flooding CDF and LERF are double, i.e., 5.7E-9/yr for CDF and 2.3E-10/yr for LERF.

These increases can be assumed to bound the total increases in CDF and LERF due to the enhancement of the automatic suppression system since any reduction in CDF and LERF from improved fire suppression has not been considered. Since both fall below the thresholds for inconsequential increases, no further analysis is warranted.

EXAMPLE 2. Enhancement to Reduce Potential for Shutdown That Results in an Increase in Fire Risk

A plant's Control Rod Microprocessor Rod Position Indication (MRPI) display cabinet, located in the Relay Room, has a tendency to overheat. This can cause a loss of MRPI which requires a manual plant shutdown via Technical Specifications. To reduce the likelihood of overheat, and therefore manual shutdown, a fan will be installed in front of the MRPI display cabinet to provide additional cooling. While it is recognized that decreasing the likelihood of the need for manual shutdown will not increase (and may decrease) both the CDF and LERF, the addition of the fan will increase the combustible loading in the Relay Room. This will increase both the CDF and LERF due to fire.

Without attempting to quantify the potential reduction in the internal events CDF and LERF resulting from the decreased likelihood of manual shutdown, we pursue a bounding analysis for the increases in fire CDF and LERF due to the additional fan. If we can show that these increases, which bound the overall (if any) increases in total CDF and LERF (including any reduction in the internal events CDF and LERF), are inconsequential (<1E-8/yr for CDF and <1E-9/yr for LERF), we need pursue this analysis no further.

The plant's fire PSA indicates that the ignition frequency of 0.083/yr for the Relay Room includes the contribution from two existing HVAC fans, contributing a total of 5.4E-5/yr to this ignition frequency, or (5.4E-5/yr)/2 = 2.7E-5/yr per fan. The total ignition frequency for the Relay Room results from contributions in addition to that from the HVAC fans (whose contribution of 5.4E-5/yr is <0.1% of the total of 0.083/yr). Therefore, we can bound the increase in Relay Room ignition frequency from the addition of the fan by assuming a fractional increase of (2.7E-5/yr)/(5.4E-5/yr)*(0.0010) = 5.0E-4 in the Relay Room ignition frequency.

The plant's fire PSA indicates that a Relay Room fire contributes 2.0% to the total fire CDF and LERF, each of which contributes 5.0% to the total internal plus external events CDF and LERF, 5.0E-5/yr and 2.0E-6/yr respectively. Thus, the total baseline fire CDF and LERF for the Relay Room, i.e., given the baseline initiator frequency of 0.083/yr, is (0.020)(0.050)(5.0E-5/yr) = 5.0E-8/yr for CDF and (0.020)(0.050)(2.0E-6/yr) = 2.0E-9/yr for LERF. Increasing the Relay Room ignition frequency by a fractional amount of 5.0E-4 results in increases in fire CDF and LERF of (5.0E-4)(5.0E-8/yr) = 2.5E-11/yr for CDF and (5.0E-4)(2.0E-9) = 1.0E-12/yr for LERF.

These increases can be assumed to bound the total increases in CDF and LERF due to the addition of the fan since any reduction in CDF and LERF from decreasing the likelihood of a manual shutdown has not been considered. Since both fall below the thresholds for inconsequential increases, no further analysis is warranted.

EXAMPLE 3. Simplification in the Fire Protection Program That Results in an Increase in Total Risk

A plant's Fire Detection Instrumentation Panel (FDIP), a feature of the plant fire protection program, has four independent power sources, one of which is an obsolete battery that the plant would like to remove and not replace. The plant's PSA indicates that failure of the FDIP, although modeled in the PSA, does not contribute to CDF or LERF above the calculational truncation value of 1.0E-10/yr. (This implies that there is no minimal cut set including failure of the FDIP with a CDF or LERF >1.0E-10/yr.) Since the battery's only function is to serve as a backup supply to the FDIP, it does not contribute to CDF or LERF above the 1.0E-10/yr threshold either.

Without attempting to quantify the actual contribution of failure of the FDIP to CDF and LERF, we pursue a bounding analysis for the increases in CDF and LERF due to the removal of the obsolete battery. If we can show that these increases are inconsequential (<1E-8/yr for CDF and <1E-9/yr for LERF), we need pursue this analysis no further.

To bound the potential increases in total CDF and LERF resulting from removal of the battery, we first assume that failure of the FDIP cannot contribute >1.0E-10/yr to the total CDF and LERF, based on the truncation value. The battery has a failure probability of 0.0020. Each of the other power sources, an additional (newer) battery and two battery chargers, has a failure probability of 5.0E-4. Since failure of all four supplies (two batteries and two battery chargers) would be necessary to fail power to the FDIP, the probability of loss of power would be the product of these four failure probabilities, i.e., $(0.0020)(5.0E\text{-}4)^3 = 2.5E\text{-}13$. Since any minimal cut set including loss of power to the FDIP would have to include this product, we can bound the contribution by the product itself, i.e., 2.5E-13/yr (this conservatively assumes all other elements of the minimal cut set have frequencies/probabilities = 1.0).

With the obsolete battery removed, the maximum contribution from the minimal cut set including loss of power to the FDIP increases to $(5.0E\text{-}4)^3$/yr = 1.3E-10/yr (an increase by a factor of 1/0.0020 = 500). This corresponds to the maximum potential increases in CDF and LERF resulting from removal of the obsolete battery. Since both fall below the thresholds for inconsequential increases, no further analysis is warranted.