LIST OF ATTENDEES

MEETING REGARDING REQUESTS FOR ADDITIONAL INFORMATION (RAIs) ASSOCIATED WITH REVIEW OF NEI 94-01, REVISION 1 (DRAFT) AND EPRI REPORT, PRODUCT NO. 1009325

FRIDAY, JUNE 17, 2005

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EPRI = Electric Power Research Institute
NEI = Nuclear Energy Institute
NRR = Office of Nuclear Reactor Regulation
DSSA = Division of Systems Safety and Analysis
SPSB = Probabilistic Safety Assessment Branch
RES = Office of Nuclear Regulatory Research
DRAA = Division of Risk Analysis and Applications
PRAB = Probabilistic Risk Analysis Branch
DE = Division of Engineering
OERAB = Operating Experience Risk Analysis Branch

ATTACHMENT 1

Risk Impact Assessment of Extended ILRT Intervals

Ken Canavan and John Gisclon
Electric Power Research Institute

Presentation to the NRC

June 2005

EPRI

ATTACHMENT 2

Background and Objectives

- Industry requested this meeting with NRC staff.
- The meeting was requested following industry's preliminary review of the Requests for Additional Information (RAI) contained in NRC letter of April, 22, 2005.
- Industry's objectives for this meeting are then to obtain clarification from the staff of:
  - The intent of the RAI
  - To provide staff some background on purpose and conduct of expert elicitation
  - Discuss the relationship between ILRT report and NEI 94-01
  - To discuss optional courses of action for addressing ILRT Interval Optimization
  - To reach consensus on a course of action to be pursued for addressing ILRT Interval Optimization.

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  - To reach consensus on a course of action to be pursued for addressing ILRT Interval Optimization.

Background

- Prior to 1995, ILRT's were conducted at basic intervals of 3 periodic tests per 10 year interval in accordance with 10 CFR 50, Appendix J.
- In 1995, the regulation was revised to add a Performance – Based Option B that permitted extension of ILRT intervals of up to 10 years, based on performance.
  - The change in the regulation was supported by several reports, including NUREG-1493, *Performance-Based Containment Leakage Test Program.*
  - Guidance to utilities was provided by NEI-94-01, *Industry Guideline for Implementing Performance-Based Option of 10CFR Part 50, Appendix J,* as endorsed by USNRC Regulatory Guide1.163, *Performance-Based Containment Leak Test Program.*
  - EPRI Report TR-104284, *Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals* provided bases for the NEI guidance.

Historical Timeline (Page 1 of 5)

- In July, 2001 industry met with NRC and discussed plans to revise NEI 94-01 to provide for Type A ILRT to be performed at least once per twenty years based on acceptable performance history.
- The revision to NEI 94-01 was to be based on a revised EPRI risk impact assessment and updated industry ILRT experience.
- After the July meeting, the following were added to the project:
  - A methodology responsive to RG 1.174
  - Promulgation of interim (standard) guidance for performing plant specific risk impact assessments in support of one-time ILRT interval extensions

Historical Timeline (Page 2 of 5)

- "Interim Guidance for Performing (plant-specific) Risk Impact Assessments in Support of One-Time Extensions for Containment Integrated Leakage Rate Test Intervals" was promulgated in November 2001.
- An NEI survey of ILRT failures and containment degradation events since 1995 was completed. 58 plants (91 units) responded.
- A database of ILRT failures and significant containment degradation events has been developed.
- The *Joint Application Report for Containment Integrated Leak Test Interval Extension (CEOG)* was obtained and integrated into the ERPI project.

Historical Timeline (Page 3 of 5)

- In May, 2002, another meeting was held with the staff to discuss the direction of methodology development, and to obtain staff's input.
  - The development of the risk impact assessment was discussed, as well as other important areas of interest, such as corrosion, alternative monitoring, and inspections.
  - Expert elicitation was discussed as a process to be used to obtain frequency and magnitude estimates for significant containment degradation and leakage events that would not be detected by inspections, tests, or alternative means to conducting ILRTs.
  - The development of the expert elicitation process and NRC involvement and/or monitoring of the process.

Historical Timeline (Page 4 of 5)

- Expert elicitation was conducted at a meeting in Charlotte in December, 2002.
  - In preparation for the meeting, communications were maintained with the staff on a variety of topics.
  - At least two series of questions posed by the staff were answered by industry, with many of the questions dealing with data.
- During the expert elicitation meetings, the leakage/ degradation data was extensively reviewed and discussed.
- Following the meeting, the elicitation data was analyzed, and the EPRI Report No. 1009325, *Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals* was developed.
- The draft report was given to all of the expert panel for review and comment, with input received from all panelists except the NRC representative who reserved comment until NRC review was complete.

Historical Timeline (Page 5 of 5)

- At about the time of ERPI report finalization, work commenced on proposed revision 1 to NEI-94-01. The revision to NEI 94-01 received input from a variety of industry experts as well.
- In December, 2003 the draft NEI 94-01, revision 1 and the supporting document, EPRI Report No. 1009325 were submitted to NRC.

Basis for Performing the Expert Elicitation

- Significant effort was expend in the data collection task
  - Not all utilities responded to survey
  - Survey supplemented by literature searches
  - Individual utilities contacted
  - While all significant abnormal ILRT results are believe to be represented in dataset, all successes are not
- No large ILRT failures in the data collected
- No clear definition of Large Early Release Frequency (LERF) is contained in current literature. LERF estimates developed range from 600–6000 La. Value of LERF used in this evaluation was conservatively 100 La.

Basis for Performing the Expert Elicitation

- Use of alternative statistical methods seem conservative (e.g., Chebychev, Jeffery's Non-Informative Prior, and others)

Statistical Method	Assumed No. of failures	No. of Demands	ILRT "Failure" Probability	Comments
Chebychev	1	182	5.5E-3	Upper bound estimate
Jeffery's Non-Informative Prior	0.5	182	2.7E-3	Based on no physical or engineering information available
Typical range	0.3	182	1.6E-3	Typical range of values for a non-informative basis
	0.1	182	5.0E-4	

*** *Jeffery's Non-Informed Prior used in prior risk-informed submittals*

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Expert Elicitation – Figure-of-Merit

- Development of Probability Versus Leakage Magnitude was decided as the figure-of-merit for the elicitation. Benefits include:
  - There have been events in the small La region.
  - Probability can be estimated for a range of leak rate sizes from small to large. (Important since LERF is not currently defined).
  - Promotes development of sensitivity cases

Expert Elicitation – Panel Members

- Expert Panel Members:
  - H. Duncan Brewer (Duke)
  - Ken Canavan (Facilitator, Data Systems & Solutions)
  - John M. Gisclon (Consultant, EPRI)
  - Alex McNeill (Dominion)
  - James C. Pulsipher (NRC)
  - Jim E. Staffiera (First Energy)
  - Henry M. Stephens, Jr. (EPRI, NDE Center)
  - Total panel years of experience 186 (average of 26.6)
  - Wide range of disciplines
  - Two NRC observers
    - Andre Drozd
    - Lee Abramson

Expert Elicitation – Panel Conduct

- The process is based on:
  - Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts" (NUREG/CR-6372)
  - Branch Technical Position on the Use of Expert Elicitation in the High-Level Radioactive Waste Program" (NUREG-1563)
- Recommendations of NRC incorporated into the conduct of the panel and information provided to the panel:
  - NRC Letter of July 2002
  - NEI / NRC Teleconference October 2002
  - Various NRC Observer Comments (Lee Abramson)
    - Almanac Example
    - Training Changes
    - Length of Expert Elicitation (additional deliberation & training)

Expert Elicitation – Panel Conduct

- Expert panel training & deliberations provided:
  - Presentation of Problem Statement
  - Presentation of the Expert Elicitation Process
  - Expert Panel Training & Almanac Example
  - PRA Concepts / Application to ILRT Optimization
  - Presentation of Containment Degradations
  - ILRT Database and other relevant data (Extensive review of containment failure modes with emphasis on difficult to inspect areas and "hidden" or yet to be discovered failure mechanisms
- Expert Elicitation Feedback
  - Experts were positive on the process
  - NRC participation provided valuable insights
  - NRC observer comments on the expert elicitation were extremely positive
  - Suggestions of NRC Observers included the use of "Trim" mean values and suggested statistical treatment.

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Expert Elicitation Results

Table 6-1: Expert Elicitation Results – Leak Size Versus Probability

Leakage Size (La)	Mean Probability of Occurrence
1	2.65E-02
2	1.59E-02
5	7.42E-03
10	3.88E-03
20	1.88E-03
35	9.86E-04
50	6.33E-04
100	2.47E-04
200	8.57E-05
500	1.75E-05
600	1.24E-05
1000	4.50E-06
2000	1.01E-06
5000	1.11E-07
10000	1.73E-08

Expert Elicitation Result Comparison

Statistical Method	Statistical Method Value	Expert Elicitated Value at 35 La	
		Value	% Diff
Based on 182 tests			
Chebychev	5.50E-03	9.86E-04	82%
Jeffery's Non-Informed Prior	2.70E-03	9.86E-04	63%
Typical Ranges	1.60E-03	9.86E-04	38%
	5.00E-04	9.86E-04	-97%
Based on 400 tests			
Chebychev	2.50E-03	9.86E-04	61%
Jeffery's Non-Informed Prior	1.25E-03	9.86E-04	21%
Typical Ranges	7.50E-04	9.86E-04	-31%
	2.50E-04	9.86E-04	-294%

- Expert elicitation results are in the range of other statistical methods

ILRT – Input Data

- John Giscoln

ILRT Extension – Analysis Approach

- Analysis approach is similar to the approach used in the approved one-time ILRT extension submittals
- Spreadsheet approach in calculation
  - Uses data from expert elicitation
  - Presents outcomes for 10, 15 and 20 year ILRT extensions
  - Uses a conservative LERF = 100 La
  - Presents sensitivity case outcomes for
    - More realistic evaluation of risk (e.g., La = 600)
    - Overly conservative evaluation of risk (e.g., La = 35)

Risk Assessment Results (20 year Interval)

- Analysis results indicate for a "typical" plant with a conservative estimate of LERF (100 La) the risk remains in the "very small risk" region of Regulatory Guide 1.174
  - The most conservative plants for which public information was available were used
  - Supports and confirms conclusions of other risk assessment impacts associated with ILRT interval extensions (e.g., NUREG-1493)
- Sensitivity cases indicated that risk is "negligible" for more realistic estimates of LERF (600 La)
- Conservative sensitivity case (La = 35) indicates risk remains in the "small region" of Regulatory Guide 1.174

Risk Assessment Results (15 Year Interval)

- Analysis results indicate for a "typical" plant with a conservative estimate of LERF (100 La) the risk remains in the "very small risk" region of Regulatory Guide 1.174
- Sensitivity cases indicated that risk is "negligible" for more realistic estimates of LERF (600 La)
- Further, the sensitivity case with the most conservative assessment of LERF (35 La) and most conservative publicly available PRA results indicates for 15 years:
  - "very small increase" in risk for the BWR
  - "small increase" for the PWR (just over "very small" criteria)

RAI Overview Observations

- Simple averages of experts for >100 La are as follows:
  - All Six Experts
    - Large Containment = 7.5E-4
    - Small Containment = 8.3E-4
  - Highest 5 Experts
    - Large Containment = 9.0E-4
    - Small Containment = 1.0E-3
- 8.8E-3 appears unreasonably conservative since no large failures have occurred in approximately 400 tests (conservatively estimated).
  - Outside the range of other statistical methods
  - Does not compare with simple averages
  - Higher than the highest expert's stated average (3.2E-3)
  - 400 * 8.8E-3 = 3.5 (182 * 8.8E-3 = 1.6)
  - High probability of observing a failure within current dataset.
- Treatment appears to focus on the statistical analysis methods as opposed to field experience and existing data.

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RAI Overview Observations

- Distributions Used in Analysis of Data
  - EPRI report distribution chosen based on best fit of expert elicited data. Other distributions were investigated.
  - NRC distribution based on split log normal.
  - No physical basis for use of any specific distribution
- It is likely application of the recommendations provided in RAI question #1 would indeed produce similar results. Since the results would no longer agree with available experience, it would be more reasonable to use alternate statistical method (e.g., Jeffery's Non-Informative Prior).
- Agree that documentation of the expert elicitation is important. The current documentation contained in the report and expert elicitation training is believed to be robust and provide for meaningful results.

RAI Observations

- Additional clarification is required on questions:
  - #3. "Provide additional justification and analysis to support a conclusion that the risk impact is very small for all containment types and sites."
  - #7. "There is no direct connection between ILRT failures and large early release".

Conclusions

- The expert elicitation and analysis, as performed, is appropriate for risk-informed extension of ILRT testing intervals
  - Represents significant improvement over the previous one-time ILRT interval extension submittals
  - Conclusions are similar to previously performed analysis (e.g., NUREG-1493, Appendix J Option B, and Interim ILRT Submittals)
  - Variations in the probability for a "extremely large leak" produce results that range from "negligible" to slightly greater than the very small risk increase region.
    - Realistic evaluation is in the "very small risk" increase region
    - Higher resulting risk increase values (i.e., "small increase") accompanied by compound conservatisms
  - NEI 94-01 revision 1 guidance along with the EPRI report provide adequate justification for the extension of ILRT intervals upto 20 years.

Path Forward

ILRT Database Summary

John Gisclon
EPRI Consultant
USNRC Presentation
June 17, 2005

EPRI

ATTACHMENT 3

Sources - Database

- The information contained in the database consists of ILRT degradation or failure events.
- Data was collected from ~1977 through 2001.
- Data was obtained from:
  - NUREG-1493
  - LER Database searches
  - Two NEI surveys, one (NUMARC) conducted in 1993 and one conducted in 2001.
  - Review of EPRI ASME IWE/IWL degradation events through ~2001.
- During this period it is estimated that at least 400 ILRT's were performed.
  - Items in the database represent off-normal events that occurred or were observed in the period.

Data Considerations

- The database was shared with the NRC staff in mid-2002
  - At least two iterations of staff inquiries were addressed.
- Database was a major topic of discussion and review by expert panel:
- Expert panel reviewed all items in the database as well as the event categorization.
  - Some changes were made to the data summary by the panel:
    - Separate input forms for large and small containments
    - Changes in the size pathways from > 10 La to 10-100La for large leak and > 100 La for extremely large
    - Eliminated "design deficiency" and "erosion" failure modes.
  - Expert panel discussed and concurred in treatment of events, as presented in Section 3 of the EPRI report.

Summary of 71 Data (Events)

- 32 involved leakages ≤1La.
- Of the remaining 39 events:
  - 18 were identified by local leak rate testing and 2 involved steam generator manway leakage.
  - Of the remaining 19:
    - 3 resulted from the practice of performing ILRT before LLRT
    - 7 were discovered by alternate means (inspections, operator observations), not impacted by ILRT frequency;

Of the remaining nine events

- Two events were detectable only by ILRT
  - One was the ejection of a radiation monitor (1.4La)
  - One was due to holes drilled in the liner, leakage unknown, but estimated to be small.
- The two largest magnitude leaks were ~21 La and 15 La. One of these leak paths was identified by LLRT, and the other would have been identified in subsequent LLRT's.

Summary

- A very extensive and thorough review of available failure/degradation event data and categorization was performed before and during the expert elicitation meeting.
- This data was used as a starting point in the elicitation process to define the frequency and magnitude of postulated containment leakage paths not identifiable by tests, inspections, or alternative means.
- No events were identified that could have resulted in a large early release, as defined in the report.