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FINAL REPLY:

Robert H. Bryan
Lewis A. Ward
Westinghouse Owners Group

TO:

Chairman Meserve

FOR SIGNATURE OF : ** GRN ** CRC NO: 01-0521

DESC:

Comments on SECY-01-0133, "Status Report on Study of Risk-Informed Changes to the Technical Requirements of 10 CFR Part 50 and Recommendations on Risk-Informed Changes to 10 CFR 50.46

ROUTING:

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SPECIAL INSTRUCTIONS OR REMARKS:

For Appropriate Action.

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AUTHOR: Robert Bryan (WOG)

AFFILIATION:

ADDRESSEE: CHRM Richard Meserve

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OG-01-059

October 2, 2001

The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Westinghouse Owners Group
Transmittal of Westinghouse Owners Group Comments on SECY 01-0133 (MUHP3062)

Dear Chairman Meserve:

The Westinghouse Owners Group (WOG) asks that the following comments in response to SECY 01-0133 be considered in the decision making process. These comments are provided to clarify the NRC's use and understanding of information the WOG has provided in public meetings and in letters. In addition to the specific comments provided below, the WOG endorses the comments NEI made in their correspondence to you dated September 10, 2001.

Priority of LBLOCA Redefinition

LBLOCA Redefinition continues to be the top priority for the WOG in the area of risk-informed regulatory changes. LBLOCA Redefinition is clearly feasible and the NRC should consider work on this initiative to be a high priority. In fact, the NRC Staff has proposed, as higher priority work, risk-informed changes that no industry groups have expressed interest in, which can potentially delay the most sought after change proposed by the industry. There remains a compelling fundamental reason to pursue redefinition: it is an artificial, non-risk-significant feature in the regulations that will continue to drive requirements as long as it remains in the regulations.

Consideration of Information Provided by Stakeholders

Significant improvement in the schedule for redefining the LBLOCA can be achieved by building on previous risk-informed applications that have been accepted by the NRC as discussed in the following paragraph.

There have been numerous NRC-industry interactions on redefining the LBLOCA since February 2000 and the WOG is disappointed that the SECY does not reflect the information provided in these meetings. Specifically, on January 11, 2001 the WOG presented information to the NRC in response to NRC questions on the Probabilistic Fracture Mechanics (PFM) work supporting the WOG LBLOCA redefinition program. This information was then transmitted to the NRC in an NEI letter from Anthony Pietrangelo to Thomas King, Director, Risk Analysis and Applications dated February 8, 2001. The WOG believes that the issues raised in Attachment 2, Appendix A to SECY 01-133 have been addressed as discussed in the information previously provided. A summary of how each of the areas within Attachment 2, Appendix A to the SECY has been addressed is included as Attachment 1 to this letter. Attachment 1 also includes an overview of the process used by the WOG to calculate piping failure probabilities and identifies references to more detailed information that the NRC can review for a better understanding of the work. The WOG requests that the staff review this information and use it as the basis of dialog between the WOG and the staff to identify which of the SECY 01-0133 Attachment 2, Appendix A items are not resolved by the information.

Benefits of LBLOCA Redefinition

On October 17, 2000, the WOG sent a letter to the NRC (R. Bryan, to T. King, NRC) which discussed the benefits of the WOG LBLOCA redefinition program. In SECY 01-0133 the NRC repeatedly makes reference to the letter and implies that the WOG letter was commenting on the benefits of each specific NRC option, which was not the case. The WOG letter was commenting specifically on the benefits of LBLOCA redefinition. The WOG has not commented on the benefits of each of the NRC options, and the references to the WOG letter within the SECY are not appropriate.

The WOG would like to clarify that the one time benefit noted on page 7 of the SECY related to baffle barrel bolt replacement can be obtained independent of rule changes related to LBLOCA redefinition. The use of Leak-before-break (LBB) for baffle barrel bolt replacement applications is a dynamic effect application allowed by GDC-4. The WOG included this benefit in our letter to T. King dated October 17, 2000 describing benefits of our program because the program includes the LBB work for 6-inch lines that facilitates this benefit. Once the 6-inch LBB work is completed, this benefit can be obtained independent of the LBLOCA Redefinition program.

Need for Option 3 Framework

The WOG does not agree with the need for and technical basis of the framework for Option 3 cited in the SECY. For changes to the plant design basis, the framework for Option 3 cited in the SECY relies too heavily on the initiating event frequency of the events of concern and too little on the core damage frequency and large early release frequency related to these events.

If you or your staff have questions on these comments, please contact one of us, Bob Bryan , TVA, at 423-751-8201, or Lewis Ward, SNC, at 205-992-7105.

Sincerely,

Robert H. Bryan
Chairman
Westinghouse Owners Group

Lewis A. Ward
Chairman
WOG LBLOCA Redefinition Working Group

Cc: All (1L, 1A)
The Honorable Greta Joy Dicus, Commissioner, NRC
The Honorable Edward McGaffigan Jr., Commissioner, NRC
The Honorable Jeffrey S. Merrifield, Commissioner, NRC
Dr. Willian D. Travers, Executive Director for Operations, NRC
WOG Primary Representatives
WOG Steering Committee Members
WOG LBLOCA Redefinition Working Group Members
A.P. Drake, Westinghouse, WOG Project Manager

OG-01-059
October 2, 2001

Bcc: All receive 1L, 1A

J. D. Andrachek	ECE 4-07A
D C Bhowmick	ECE 309B
S. Sancaktar	ECE 467B
J.M. Brennan	ECE 4-16
J.A. Gresham	ECE 4-17
H.A. Sepp	ECE 3-22

WOG Project Office:

S.A. Binger	ECE 5-16
R.B. Sisk	ECE 5-16
P.V. Pyle	ECE 5-16

CEOG Project Office:

P.J. Hijeck	Windsor
S. W. Lurie	Windsor
G.C. Bischoff	Windsor

ATTACHMENT 1

WOG Resolution of Issues Contained in SECY 01-133, Attachment 2, Appendix A

Table 1 provides a high level summary response to NRC concerns identified in Attachment 2, Appendix A. This table is followed by a description of the methods used to calculate the piping failure probabilities in support of the LBLOCA redefinition program and includes references to more detailed information.

Table 1 – Summary Response to NRC Concerns on PFM Analysis of Piping in Attachment 2 of SECY-01-133

NRC Concern	WOG/Westinghouse Response
4.2 PFM Computer Code QA	All computer codes used for RI-ISI calculations are required to be QA approved. All nuclear vendor codes meet these QA requirements.
A(2) Initial Flaw Distribution	Latest PRODIGAL work on piping weld flaws was used in SRRA calculations for RI-ISI
A(3) Degradation Mechanisms	All mechanisms of concern, including SCC, flow assisted corrosion and thermal striping, are considered the SRRA for RI-ISI.
A(4) Normal Operating & Transient Loads	All normal loads of concern, including residual stress, and transient loads due to seismic and water hammer events are considered.
A(5) Pipe-System Boundary Conditions and Postulated Flaw Locations	Inside surface breaking flaws in worst orientation and location are assumed; uncertainties in loading restraints are also considered.
A(6) Material Response • Strength of Material • Fatigue/Environmental Crack Initiation • Fatigue Crack Growth and Environmental Effects • Fracture Toughness	These piping material response concerns are evaluated with the SRRA Code. Crack initiation due to fatigue or IGSCC can be evaluated in more detail using other available codes, such as PRAISE.
A(7) Leak-Rate Estimation	Latest leak-rate models (SQUIRT and PICEPS) are used in Ver. 3.0 of pc-PRAISE and SRRA for calculating large leak probability and effects of small leak detection.
A(8) In-Service Inspection	Probability of detection with flaw size during ISI and its effects on leak probability are considered in SRRA and PRAISE models.
A(9) Uncertainty Analyses	Although SRRA Code has been benchmarked against IGSCC and FAC data and PRAISE for high and low cycle FCG, uncertainty factors from 5 to 20 are still applied to the SRRA point estimate to get a mean value.
A(10) Other Failures	The RI-ISI process does allow for the potential impact of future degradation mechanisms in its uncertainties.

WOG Calculation of Piping Failure Probabilities

The probability that a pipe leak large enough to cause a large-break loss of coolant accident (LBLOCA) can happen is calculated for the LBLOCA redefinition program using structural reliability methods. In the WOG risk-informed in-service inspection (RI-ISI) program (Ref. 1), a probabilistic fracture mechanics (PFM) approach is used to calculate the probabilities of piping leaks during normal operation or breaks during some design limiting event, such as a safe shutdown earthquake (SSE). The structural reliability and risk assessment (SRRA) models and verification of calculated results are described in WCAP-14572, Rev. 1-NP-A, Supplement 1 (Ref. 2). The primary capability of the SRRA computer software is to estimate the probability of exceeding the specified limits for a given piping failure mode as a function of time due to the combined effects of the modeled degradation (aging) mechanisms and uncertainties. The piping failure modes considered are:

1) small leak (through-wall crack),
2) large (system disabling) leak and
3) full break (exceed material flow stress in uncracked section) during a postulated design-limiting event.

The piping materials considered are type 304 and 316 stainless steel and carbon (ferritic) steel. The degradation mechanisms modeled include:

1) low-cycle fatigue crack growth of an existing (fabrication) flaw using the latest ASME B&PV Code fatigue crack growth curves for both stainless and ferritic steel welds in a water environment,
2) high-cycle fatigue stress, such as vibration, exceeding the fatigue crack threshold,
3) stress corrosion crack growth of an existing flaw and
4) wall thinning due to wastage, such as flow assisted corrosion.

The effects of flaws initiated by high-cycle fatigue or stress corrosion cracking early in life can also be conservatively estimated. Otherwise, there is a probability that an initial flaw exists due to errors in the weld fabrication process, including in-process inspections. The weld geometry, particularly the through-wall thickness, typical fabrication techniques and effect of repairs are considered in defining the initial flaw characteristics used in the SRRA models. These initial flaw characteristics (depth, its uncertainty and the flaw density) are as specified in Figure 4.1 and Table 4.1 of the NRC requirements (Ref. 3). They are derived from a simulation of typical weld fabrication and inspection methods for three sizes of welds (0.25, 1.0 and 2.5 inch) using an NRC piping version of the PRODIGAL Code. The SRRA computer code also has the capability to estimate the effects of leak detection and in-service inspections as a function of the input values for a detectable leak rate or the accuracy and frequency of ISI.

The LBLOCA leak analysis is done probabilistically using Monte-Carlo simulation of all the uncertainties that could potentially contribute to large leaks or breaks. After each period of crack growth, typically one year, the crack size is checked to see if it is big enough to cause a LBLOCA leak rate during its normal operating conditions or big enough to break under some design limiting event (e.g. SSE) loading but not big enough to cause a detectable leak rate. Typical uncertainties that are considered in the SRRA calculations are:

1) pipe geometry,
2) depth and length of the initial weld flaws,
3) residual stresses and stresses due to the piping loading conditions (pressure, deadweight, thermal, high and low-cycle stress ranges and design limiting stress, such as that due to a safe shutdown earthquake),
4) crack growth rate coefficients (fatigue and stress corrosion) and
5) material wastage rate.

The input to the SRRA software for piping RI-ISI is provided by a plant engineering team. The engineering team members have experience in ISI and NDE, materials behavior and piping integrity evaluation. Any pertinent plant inspection or operations experience is also considered along with the potential for any other degradation mechanisms that have been documented in the industry failure experience databases. To ensure that the SRRA input parameters are consistently assigned and the SRRA computer code properly executed, the engineering team for SRRA input is trained and qualified by Westinghouse instructors.

The SRRA models and their uncertainties have been independently reviewed by the ASME Research Task Force that developed the Guidelines for Risk-Based Inspection (Ref. 4) and satisfy the NRC's requirements for probabilistic structural mechanics computer codes for estimating failure probabilities (Chapter 4 of Ref. 3). Section 3.2.3 and Appendix A of the NRC safety evaluation report (SER, Ref. 5) specifically address the adequacy of the piping SRRA models (Ref. 2). Section 3.6.1 of the WOG WCAP (Ref. 1), Section 3.3.2.2 of the SER (Ref. 5) and Section 4.4 of the NRC Requirements (Ref. 3) all discuss the expected uncertainties (factors from 5 to 20) on probabilities calculated using the PFM approach in SRRA. This type of uncertainty is used to estimate a mean value of LBLOCA probability that is higher than the point estimate value calculated using SRRA. Finally, Section A.13.2 of the SER (Ref. 4) on Validation with Operating Experience states that the SRRA "predictions of overall failure rates, predicted degradation mechanisms, and the most likely locations for piping failures show an acceptable level of agreement with plant operating experience."

As previously noted, we believe that the SRRA method for piping RI-ISI addresses all the NRC reviewer's concerns on use of PFM methods for LBLOCA probability in SECY-01-133, as summarized in Table 1.

References

1. WCAP-14572, Rev. 1-NP-A, *Westinghouse Owners Group - Application of Risk-Based Methods to Piping Inservice Inspection - Topical Report*, Westinghouse Energy Systems, February 1999

2. WCAP-14572, Rev. 1-NP-A, Supplement 1, *Westinghouse Structural Reliability and Risk Assessment (SRRA) Model for Piping Risk-Informed Inservice Inspection,* Westinghouse Energy Systems, February 1999

3. NUREG-1661, *Technical Elements of Risk-Informed Inservice Inspection Programs for Piping – Draft Report,* U.S. Nuclear Regulatory Commission, January 1999

4. NUREG/GR-005 (CRTD-Vol.20-1), Vol. 1, R5, RG, *Risk-Based Inspection – Development of Guidelines, General Document,* ASME Research Task Force on Risk-Based Inspection Guidelines, February 1992

5. Letter to WOG Steering Committee, *Safety Evaluation of Topical WCAP-14572, Revision 1, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report,"* U.S. Nuclear Regulatory Commission, December 15, 1998

Westinghouse Electric Co
WESTINGHOUSE OWNERS GROUP
P.O. BOX 355
Pittsburgh, PA 15230

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The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852