Westinghouse Non-Proprietary Class 3

WCAP - 14572
Revision 1-NP-A
Addendum 1

Addendum to "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report" to Address Changes to Augmented Inspection Requirements

Westinghouse Electric Company LLC

Addendum to "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report" to Address Changes to Augmented Inspection Requirements

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TABLE OF CONTENTS

LIST OF TABLES

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EXECUTIVE SUMMARY

By letter dated December 15, 1998 from Thomas Essig, U.S. Nuclear Regulatory Commission, to Mr. Lou Liberatori, Chairman, Westinghouse Owners Group (reference 1), the NRC forwarded a Safety Evaluation Report (SER) finding the Westinghouse Owners Group (WOG) risk-informed inservice inspection (ISI) methodology for piping to be acceptable. Currently, the WOG Topical Report and the NRC's Safety Evaluation state that the application of the methodology is approved as an alternative to the ASME Section XI ISI requirements and do not include changes to augmented piping inspection programs that cover some degradation mechanisms that may have been separately required by NRC.

This addendum to WCAP-14572, Revision 1-NP-A, dated February 1999, provides additional guidance related to changing the augmented inspection regulatory requirements using the WOG risk-informed ISI methodology (RI-ISI), as an option.

The WOG RI-ISI methodology is directly applicable to the consideration of augmented inspection programs; no specific changes to the overall process are required to address augmented inspection programs. The augmented inspection programs are already credited in the methodology without changing the actual regulatory requirements.

This addendum to the RI-ISI process permits, as an option, the revision of selected augmented inspection regulatory requirements (including high energy line break (HELB) exclusion and moderate energy line break (MELB) exclusion examinations), where safety impacts can be shown to be maintained or enhanced. Thus, the augmented inspections are subsumed into the RI-ISI program. Changes to these augmented requirements would be evaluated by individual utilities using the appropriate regulatory change mechanisms (e.g., 10CFR50.55a, 50.59).

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1.0 INTRODUCTION

By letter dated December 15, 1998 from Thomas Essig, U.S. Nuclear Regulatory Commission, to Mr. Lou Liberatori, Chairman, Westinghouse Owners Group (NRC, 1998), the Nuclear Regulatory Commission (NRC) forwarded a Safety Evaluation Report (SER) finding the Westinghouse Owners Group (WOG) risk-informed inservice inspection (ISI) methodology for piping (WCAP-14572, Revision 1) to be acceptable. Currently, the WOG Topical Report and the NRC's Safety Evaluation state that the application of the methodology is approved as an alternative to the ASME Section XI ISI requirements and do not include changes to augmented piping inspection programs that cover some degradation mechanisms that may have been required by NRC. Specifically, the WCAP and SER state that the report should not be taken as a basis to change augmented inspection programs.

Per the transcript of the September 2, 1999 meeting of the NRC Advisory Committee on Reactor Safeguards in which the Electric Power Research Institute risk-informed ISI methodology was discussed, the NRC stated that "Basically all of the programs that are currently addressed by augmented programs will be included or subsumed into the risk-informed methodology. The only exceptions are the intergranular stress corrosion cracking (IGSCC) Category B through G welds and the flow-assisted corrosion (FAC) program. So the programs such as the thermal fatigue augmented inspection programs or the stress corrosion cracking program, localized corrosion program, programs like that have been subsumed into the risk-informed ISI program."

As stated in the NRC's SER for the WOG RI-ISI methodology (NRC, 1998), "For calculating risk rankings, augmented programs such as erosion-corrosion and stress corrosion cracking programs are credited when the augmented program is deemed adequate to detect relevant degradation mechanisms. Augmented programs are also credited in the change of risk evaluation for both ASME Section XI programs and RI-ISI programs." In effect, the WOG RI-ISI methodology already addresses the impact of augmented inspection programs.

This addendum to the WOG RI-ISI process (WCAP-14572, Revision 1-NP-A, dated February 1999) permits, as an option, the revision of selected augmented inspection regulatory requirements (including high energy line break (HELB) exclusion and moderate energy line break (MELB) examinations), where safety impacts can be shown to be maintained or enhanced. Thus, the augmented inspections are subsumed into the RI-ISI program. Changes to these augmented requirements would be evaluated using the appropriate regulatory change mechanisms (e.g., 10CFR50.55a, 50.59) and would be submitted by individual utilities as part of the RI-ISI example submittal (NEI, 1999).

2.0 APPLICATION SPECIFICS

The application of WCAP-14572, Revision 1-NP-A to augmented inspection program requirements is in accordance with RG-1.174 (NRC, 1998) criteria and addresses the following programs:

- Thermal fatigue, including stratification (NRC Bulletins 88-08 and 88-11 and Information Notice 93-020) (NRC, 1988 & 1993)

- Stress corrosion cracking program for PWRs and intergranular stress corrosion cracking (IGSCC) Category A for BWRs (NRC Bulletin 79-17, Generic Letter 88-01 and NUREG-0313 (NRC, 1979 & 1988)); other IGSCC categories remain unchanged

- Inspections in high energy line break (HELB) and moderate energy line break (MELB) exclusion zones

- Other plant-specific augmented inspection programs

Table 1 provides additional clarification and process changes with respect to the specific steps in the application of the WCAP-14572, Revision 1-NP-A methodology.

Table 2-1 Additional Clarification for WCAP-14572, Revision 1-NP-A to Allow Changes to Augmented Inspection Requirements

Affected Page/Section	Current	Clarification to Address Augmented Programs
Executive Summary		*(insert on page iii after bullets)* *The RI-ISI process also permits, as an option, the revision of selected augmented inspection requirements (including high energy line break (HELB) exclusion and moderate energy line break (MELB) examinations), where safety impacts can be shown to be maintained or enhanced. Changes to these augmented requirements would be evaluated by individual utilities using the appropriate regulatory change mechanisms (e.g., 10CFR50.55a, 50.59.).*
Page 4, Section 1.1, Program Objectives/ Summary of Regulatory Requirements and Compliance	This report documents an alternative to the current ASME Section XI program for piping. The risk-informed ISI program will be substituted for the current examination program on piping. Additionally, the alternative program will not be limited to ASME Class 1 or Class 2 piping but will now encompass the high safety significant piping segments identified through the process regardless of ASME Class. *This report provides an alternative inspection location selection method for NDE and does not affect current Owner-defined augmented programs.*	*This report provides an alternative inspection location selection method for NDE and allows for changing the requirements of current augmented inspection programs.*
Page 13, Table 1.4-1	It provides an alternative inspection location selection method for NDE and does not affect Owner-defined augmented programs.	*It provides an alternative inspection location selection method for NDE and allows for changing the requirements of current augmented inspection programs.*

Table 2-1 Additional Clarification for WCAP-14572, Revision 1-NP-A to Allow Changes to Augmented Inspection Requirements

Affected Page/Section	Current	Clarification to Address Augmented Programs
Page 14, Table 1.4-1	The proposed change is an alternative to the ASME Section XI Code as referenced by 10CFR50.55a(a)(3).	*The proposed change is an alternative to the ASME Section XI Code as referenced by 10CFR50.55a(a)(3) and, as an option, to the current augmented inspection regulatory requirements.*
Page 51, Section 3.2, Scope Definition	A full scope program.... Consistent agreement...	*(insert between the two paragraphs)* *In addition, a decision should be made as to whether or not to include changes to augmented inspection program requirements as part of the program.*
Page 81, Section 3.5.5, Consideration of Other Piping Reliability Programs	It is important to recognize the distinction between risk-informed alternative ASME Section XI examinations and other examinations and monitoring performed under an augmented program. *The alternative inspection proposed pertains only to the ASME Section XI pipe weld examination program (Categories B-F, B-J, C-F-1, C-F-2, and applicable Class 3 and Non Class piping).* Augmented examination requirements would remain unaffected. There may be cases where the risk-informed program identifies a piping segment not currently in an augmented program which may need to be added.	*The alternative inspection pertains to the ASME Section XI pipe weld examination program (Categories B-F, B-J, C-F-1, C-F-2, and applicable Class 3 and Non Class piping) and, as an option, to augmented inspection program requirements.*

Table 2-1 Additional Clarification for WCAP-14572, Revision 1-NP-A to Allow Changes to Augmented Inspection Requirements

Affected Page/Section	Current	Clarification to Address Augmented Programs
Page 105, Section 3.6.1, Risk-Ranking	For piping segments that are included in augmented programs (such as erosion-corrosion and stress corrosion cracking programs), the SRRA failure probabilities with ISI but without leak detection are used.	*For piping segments that are included in augmented inspection programs that will remain unchanged under the risk-informed ISI program, the SRRA failure probabilities with ISI but without leak detection are used.* *For piping segments that are included in augmented inspection programs that are being changed with this application, the SRRA failure probabilities without ISI and without leak detection are used.*
Page 168, Section 3.7.1, Structural Element Selection Matrix	Region 1 discussion All susceptible locations in the segment identified by the engineering subpanel as being likely to be affected by a known or postulated failure mechanism, and that are not already in an augmented program, must be examined. Segments with failure modes that have established augmented programs (e.g., flow-accelerated corrosion, intergranular stress-corrosion cracking) would be inspected in accordance with that existing program.	*All susceptible locations in the segment identified by the engineering subpanel as being likely to be affected by a known or postulated failure mechanism must be examined. Segments with failure modes that have established augmented programs would be inspected in accordance with the risk-informed ISI program, if these augmented examinations are being subsumed into the risk-informed ISI program, or by the existing augmented program if the requirements are not being changed.*

Table 2-1 Additional Clarification for WCAP-14572, Revision 1-NP-A to Allow Changes to Augmented Inspection Requirements

Affected Page/Section	Current	Clarification to Address Augmented Programs
Page 190, Section 4, Inspection Program Requirements	Experience has shown that when an active degradation mechanism (such as IGSCC, thermal striping or flow-accelerated corrosion) is discovered, corrective actions and augmented programs are implemented to address the concern. Augmented inspection programs for these situations tend to have intervals less than 10 years. Through the RI-ISI process, situations may be identified on a plant-specific basis where an aggressive mechanism may potentially occur (e.g., back-leakage of hot water across a check valve into a piping segment containing cooler water, thereby inducing the potential for thermal striping). For these situations, the licensee may choose to either implement examinations more frequently than every 10 years (including the use of thermal monitors) or implement changes to minimize the potential for the identified phenomenon. If the licensee chooses to implement a program that will provide vital information more frequently than every 10 years, then that new information would have to be evaluated at the time that is obtained to determine if a change to the prior RI-ISI results is necessary.	*(add additional paragraph following paragraphs shown in previous column)* *The licensee can choose to subsume augmented programs by also permitting the revision of selected augmented inspection requirements, where the failure mechanism may not be as aggressive and where safety impacts can be shown to be maintained or enhanced. If this alternative is chosen, the licensee should ensure that the RI-ISI program includes a reasonable representation (balance) of augmented ISI examinations and ASME Section XI examinations. The Perdue statistical model is used to determine the minimum number of ASME Section XI exams to support a reasonable representation, where appropriate.*

Table 2-1 Additional Clarification for WCAP-14572, Revision 1-NP-A to Allow Changes to Augmented Inspection Requirements

Affected Page/Section	Current	Clarification to Address Augmented Programs
Page 213, Section 4.4.2, Risk/Safety Evaluation	For piping segments that are part of augmented programs (such as erosion-corrosion and stress corrosion cracking), the SRRA failure probabilities with ISI are used (no change from previous calculations).	*For piping segments that are included in augmented inspection programs that will remain unchanged under the risk-informed ISI program or for piping segments that will be examined under the RI-ISI program (including subsumed augmented inspections), the SRRA failure probabilities with ISI but without leak detection are used.* *For piping segments that are not included in the RI-ISI program and/or for which augmented examinations are being removed, the SRRA failure probabilities without ISI and without leak detection are used.*
Page 237, Section 5, Plant-Specific Application Process	This section provides the framework for applying the risk-informed methods to a specific plant for piping inservice inspection.	*This section provides the framework for applying the risk-informed methods to a specific plant for piping inservice inspection, including both ASME Section XI and augmented inspection program requirements.*
Page 246, Section 6.1, Report Summary and Relationship to NRC RG-1.174	This process meets the intent of the framework developed by the NRC and key steps and principles of the general regulatory guide and standard review plan (R.G.-1.174) as described in Sections 1.4 and 6.2.	*(insert new sentence at end of second paragraph)* *The process can be applied to both ASME Section XI and augmented inspection requirements.*

3.0 SPECIFIC GUIDANCE FOR HELB AND MELB AUGMENTED ISI EXAMINATION EVALUATION AS PART OF THE RISK-INFORMED ISI PROGRAM

3.1 BACKGROUND

Current design criteria for the postulation and protection of pipe breaks in high energy lines (and in some cases, moderate energy) have been developed over a period of time and the requirements vary from plant-to-plant when applied inside and outside containment. General Design Criterion 4 (GDC-4) of Appendix A to 10 CFR Part 50 provides the basic requirements for protection against dynamic effects of postulated pipe ruptures.

As part of this evolution, augmented ISI examinations have been permitted to provide assurance of protection in specific instances where the installation of restraints or shields is not practical. Plants have also identified break exclusion zones such as in certain high energy piping systems in the containment penetration areas where augmented ISI has been allowed to assure protection. Augmented ISI for HELB requirements are addressed in NRC Standard Review Plan 3.6.1, 3.6.2 and 6.6 (NRC, 1990, 1981, 1981) and plant specific SAR commitments. A provision exists for an applicant to propose acceptable alternative method for complying with specified portions of the NRC SRP 3.6.1 section V.

These augmented inspections usually comply with the requirements of the applicable edition of Section XI of the ASME Code and addenda. However, the frequency of these inspections can be increased over that required by Section XI such that some plants inspect these locations three times during each 10-year inspection interval.

The majority of HELB and MELB augmented exams are generally associated with the Class 2 piping systems; therefore, a risk-informed ISI program that includes Class 2 piping (i.e., a Class 1&2 or full scope risk-informed ISI program) is usually necessary to perform this application.

3.2 SPECIFIC GUIDANCE FOR HELB AND MELB ISI INCLUSION

This evaluation can be performed concurrently with the application of the RI-ISI program (e.g., Class 1 and 2 ASME Section XI) or can be performed following completion of the program.

Scope Definition

The program scope is evaluated to include those systems for which HELB break exclusion ISI is performed.

Segment Definition

The piping segments defined in the RI-ISI program are reviewed to identify which piping segments are impacted by the augmented ISI program. Any further refinement of the piping segments is also performed.

Consequence Evaluation

An in-depth review of the requirements for break exclusion zones and supporting design basis documentation with respect to postulated consequences and locations is performed based on the current risk-informed ISI piping segments and postulated consequences. A plant walkdown of the affected piping may be performed to confirm information provided in existing design basis documentation.

Any changes necessary to the postulated consequences are identified and incorporated into the analyses and the PRA model is used to estimate the conditional core damage frequency/large early release frequency (CDF/LERF) probability/frequency.

Piping Failure Probability Assessment

A detailed review of the piping failure probabilities used in the risk-informed ISI program for the segments impacted by break exclusion zones is performed with respect to postulated failure mechanisms and credit for the augmented ISI program. Any new failure probabilities are calculated using the Westinghouse SRRA software (Westinghouse, 1999).

Risk Evaluation

The results from the consequence evaluation and failure probability assessment are reviewed to identify the impact on the risk evaluation and risk ranking calculations. The identification of the potential re-ordering of the high safety-significant (HSS) piping segments based on removing credit for the augmented ISI program is performed. This information is then provided to the plant expert panel.

Expert Panel Categorization

The suggested changes to the risk-informed ISI program and the augmented ISI program are presented to the plant expert panel for final determination of which piping segments are HSS and should receive examination. The expert panel findings are documented.

Structural Element/NDE Selection

Based on the changes proposed by the plant expert panel to the piping segments identified as HSSC, the number of structural elements to be examined and the nondestructive examination (NDE) methods are identified based on the guidance provided in WCAP-14572, Revision 1-NP-A. The change in risk calculations based on inputs from the risk ranking calculations, the piping segments which are in the current RI-ISI program and those that are proposed to be added to address the augmented ISI, are evaluated to ensure the program does not result in an increase in risk and meets the guidance in NRC RG-1.174 (NRC, 1998).

When changing the HELB and MELB exclusion examinations by subsuming the exams into the RI-ISI program, the licensee should ensure that the RI-ISI program includes a reasonable representation (balance) of augmented ISI examinations and ASME Section XI examinations.

The Perdue statistical model is used to determine the minimum number of ASME Section XI exams to support a reasonable representation, where appropriate.

4.0 CONCLUSIONS

The WOG RI-ISI methodology is directly applicable to the consideration of augmented inspection programs; no specific changes to the overall process are required to address augmented inspection programs. The augmented inspection programs are already credited in the methodology without changing the actual regulatory requirements.

This addendum to the RI-ISI process permits, as an option, the revision of selected augmented inspection regulatory requirements (including high energy line break (HELB) exclusion and moderate energy line break (MELB) examinations), where safety impacts can be shown to be maintained or enhanced. Thus, the augmented inspections are subsumed into the RI-ISI program. Changes to these augmented requirements would be evaluated by individual utilities using the appropriate regulatory change mechanisms (e.g., 10CFR50.55a, 50.59).

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