March 1, 2004

Mr. Gordon Bischoff, Manager
Owners Group Program Management Office
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, PA 15230-0355

SUBJECT: FINAL SAFETY EVALUATION FOR TOPICAL REPORT 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" (TAC NO. MA7995)

Dear Mr. Bischoff:

By letters dated December 21, 1999, June 2, 2000, December 20, 2002, and July 21, 2003, Westinghouse Owners Group (WOG) submitted Topical Report (TR) WCAP-14572, Rev. 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," (hereafter WCAP-Addendum) to the staff for review. On December 22, 2003, an NRC draft safety evaluation (SE) regarding our approval of WCAP-Addendum was provided for your review and comments. By letter dated January 21, 2004, Westinghouse commented on the draft SE. The staff's disposition of your comments on the draft SE are discussed in the attachment to the final SE enclosed with this letter.

The staff has found that the WCAP-Addendum is acceptable for referencing as an approved methodology in plant licensing applications. The enclosed SE documents the staff's evaluation of the WOG's justification for the improved methodology.

Our acceptance applies only to the material provided in the subject TR. We do not intend to repeat our review of the acceptable material described in the TR. When the TR 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 this TR will be subject to a plant-specific review in accordance with applicable review standards.

In accordance with the guidance provided on the NRC TR website, we request that the WOG publish an accepted version of this TR within three months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed SE between the title page and the abstract. It must be well indexed such that information is readily located. Also, it must contain in appendices historical review information, such as questions and accepted responses, draft SE comments, and original report pages that were replaced. The accepted version shall include a "-A" (designating "accepted") following the report identification symbol.

If the NRC's criteria or regulations change so that its conclusions in this letter, that the TR is acceptable, is invalidated, the WOG and/or the licensees referencing the TR will be expected to revise and resubmit its respective documentation, or submit justification for the continued applicability of the TR without revision of the respective documentation.

Sincerely,

/RA by Robert A. Gramm for/
Herbert N. Berkow, Director
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 694

Enclosure: Safety Evaluation

cc w/encl:
Mr. James A. Gresham, Manager
Regulatory Compliance and Plant Licensing
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, PA 15230-0355

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT 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 OWNERS GROUP

PROJECT NO. 694

1.0 INTRODUCTION

On December 21, 1999, the Westinghouse Owners Group (WOG) transmitted Addendum 1 to WCAP-14572, Revision 1-NP-A, "Addendum to 'Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report' to Address Changes to Augmented Inspection Requirements," to the NRC for review and approval (Reference 1) (hereafter, WCAP Addendum). Further clarifying information and revised pages to the WCAP Addendum were enclosed in the June 2, 2000, December 20, 2002, and July 21, 2003, letters (References 2, 3, and 4).

On December 15, 1998, the staff approved the WOG methodology as documented in WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk Informed Methods to Piping Inservice Inspection Topical Report" (Reference 5). WCAP-14572, Revision 1-NP-A (hereafter, WCAP TR) provides technical guidance for categorizing and selecting piping components for inspection based on their risk significance as an alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Inservice Inspection (ISI) Requirements for Piping. The WCAP TR and the NRC staff's safety evaluation (SE) approving it, state that the application of the methodology is approved as an alternative 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 do not include changes to augmented piping inspection programs. Augmented examination requirements would remain unaffected.

2.0 REGULATORY BASIS AND BACKGROUND

Section 50.55a, Codes and Standards, of Title 10 of the Code of Federal Regulations (10 CFR) provides the regulatory framework for nuclear power plant piping inspection programs. This section of the regulations requires licensees to develop and follow a detailed program of piping inspection that meets the detailed requirements of the ASME Code, Section XI.

The WCAP Addendum provides guidance on applying the WCAP TR methodology to augmented inspection programs that cover specific degradation mechanisms. The augmented inspection programs listed in the WCAP Addendum that are proposed to be subsumed into the risk-informed inservice inspection (RI-ISI) program are the programs developed in response to the following NRC generic communications and the Standard Review Plan (SRP):

- NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to RCS"
- NRC Information Notice 93-20, "Thermal Fatigue Cracking of Feedwater Piping to Steam Generators"
- NRC Bulletin 79-17, "Pipe Cracks in Stagnant Borated Water Systems at PWR Plants"
- Generic Letter 88-01, Supplement 1, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping" (Category A welds only)
- Inspection programs in the high energy line break (HELB) and moderate energy line break (MELB) exclusion zones located in the break exclusion region (BER) addressed in SRP Chapters 3.6.1, 3.6.2 and 6.6. The term "HELB exclusion area" as discussed in WCAP-14572 Revision 1-NP-A, Addendum 1 is the BER as addressed in SRP Chapters 3.6.1, 3.6.2, and 6.6

Other NRC-mandated plant-specific augmented piping inspection programs (e.g., flow assisted corrosion) would be submitted to and approved by the NRC on a plant-specific basis. Licensee's submittals would have to address why the WCAP TR approach is applicable to the augmented program and how the methodology was applied.

Inspection programs in the HELB and MELB zones in the BER are different from the other four programs in that they are not directed toward specific degradation mechanisms. 10 CFR 50, Appendix A, General Design Criterion 4 (Reference 6) requires that structures, systems, and components (SCCs) important to safety shall be designed to accommodate the effects of postulated accidents, including appropriate protection against the dynamic and environmental effects of postulated pipe ruptures. The staff has issued a number of documents that provide guidance for implementing these design requirements. The guidance covers the scope of applicable systems, locations to postulate breaks, methods of analyzing pipe whip forces and displacements, design of pipe whip restraints, methods of analyzing jet impingement forces and expansion zones, and methods for evaluating the integrity of components subjected to these dynamic loads. The staff also provides guidance for evaluating high energy line breaks in the containment penetration areas.

The NRC letter dated July 12, 1972 from J. F. O'Leary, Director of Licensing (Reference 7) is an early NRC document that discusses situations where pipe breaks need not be postulated. Appendix A, paragraph A.4, of the letter states:

> For those portions of the piping passing through primary containment penetrations and extending to the first outside isolation valve, pipe breaks need not be postulated provided such piping is conservatively reinforced and restrained beyond the valve such that, in the event of a postulated pipe break

> outside containment, the transmitted pipe loads will neither impair the operability of the valve nor the integrity of the piping or the containment penetration. (A terminal end of such piping is considered to originate at this restraint location.)

Although details of the BER design criteria were not provided in this letter, the preceding paragraph summarizes the philosophy of the BER. It indicates that: (1) the BER extends to the first isolation valve outside containment, (2) a restraint needs to be placed beyond the isolation valve to protect the piping in the zone from the effects of a break outside the zone, and (3) the restraint is considered to be the terminal end break location. The plant specific BER is described in the Updated Safety Analysis Report (USAR).

In November 1975, the staff issued SRP Chapter 3.6.2 (Reference 8) and it is the primary document for determining the locations of postulated breaks. Branch Technical Position MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," (BTP MEB 3-1), attached to SRP 3.6.2, states that breaks and cracks need not be postulated in BER piping provided they meet certain design and inspection criteria. Paragraphs B.1.b.(1) through (7) of BTP MEB 3-1 provide the details on the containment penetration BER design criteria including a criterion for augmented inservice inspection. This criterion states:

> A 100% volumetric inservice examination of all pipe welds should be conducted during each inspection interval as defined in IWA-2400, ASME Code, Section XI.

3.0 SUMMARY OF PROPOSED APPROACH

The methodology and procedures in the WCAP TR, as modified by the WCAP Addendum, will be used by licensees to define the scope of a risk-informed (RI) inspection program for piping in lieu of the ASME Code, Section XI piping inspections and in lieu of the requirements in the augmented programs discussed in Section 2.0 of the WCAP Addendum. The augmented programs may be incorporated into a RI inspection program developed according to the WCAP TR and previously approved by the staff, as discussed further in Section 4.1 of this SE. A licensee using the methodology to incorporate the augmented programs listed in the WCAP Addendum into an existing RI-ISI program will be expected to incorporate the results of its evaluation into plant-specific program procedures that are consistent with the performance-based implementation and monitoring strategies specified in Regulatory Guide (RG) 1.178, "An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping" (Reference 9), the ASME Code, Section XI, and the WCAP TR.

Deviations from the NRC's approved methodology described in the WCAP TR or in the WCAP Addendum need to be identified and submitted to the staff for prior review and approval. A licensee that incorporates other NRC mandated plant-specific augmented piping inspection programs (e.g., flow assisted corrosion) in an RI-ISI program other than those listed in Section 2.0 of the WCAP Addendum, shall submit to the NRC for review a description of the program(s) and justification for incorporating the program(s) into the RI-ISI program.

4.0 EVALUATION

For this SE, the NRC staff reviewed the WCAP TR methodology as modified by the WCAP Addendum with respect to the guidance contained in RG 1.178 and SRP Chapter 3.9.8

(Reference 10). These documents describe acceptable methodology, acceptance guidelines, and a review process for proposed plant-specific, RI changes to ISI of piping programs. Further guidance is provided in RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 11) and in SRP Chapter 19.0 (Reference 12) which contains general guidance for using probabilistic risk assessments (PRAs) in RI decisionmaking.

4.1 Proposed Changes to the Augmented Programs

Licensees will identify, evaluate, and implement changes to the piping structural element inspection locations and the number of structural elements to inspect for the augmented programs listed in the WCAP Addendum based on the WCAP TR methodology as modified by the WCAP Addendum. Specific pipe systems, segments, and welds, as well as revisions to inspection scope, schedule, locations, and techniques, are plant-specific and, therefore, are not directly included in this evaluation.

In cases where the licensee has been authorized by the NRC to implement a RI-ISI program in lieu of the ASME Code, Section XI, program, licensees may implement changes to the augmented programs described in the final safety analysis report (FSAR) according to the provisions of 10 CFR 50.59 (Reference 13). Changes to a licensee's augmented programs, as described in the FSAR, may be made under 10 CFR 50.59 if the evaluation criteria are met. As applied to methodologies in the FSAR, prior approval is not required if the change involves the use of a method approved by the NRC for the intended application. Changes to these augmented programs will need to be evaluated using the appropriate regulatory change mechanisms (e.g., 10 CFR 50.55a, 10 CFR 50.59) and would be submitted by individual utilities as part of the RI-ISI template submittal. If an augmented program is described in the technical specifications, the licensee must request a license amendment. Changes to weld inspection locations and changes to the percentage of welds to be inspected which are developed according to an ASME Section XI inspection program require a 10 CFR 50.55a submittal to the staff and may not be made according to the provisions of 10 CFR 50.59.

4.2 Engineering Analysis

According to the guidelines in RGs 1.174 and 1.178, licensees proposing a RI-ISI program should perform an analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. For the RI-ISI program methodology, an engineering analysis includes determining the scope of piping systems included in the program, establishing the methodology for defining piping segments, evaluating the failure potential of each segment, and determining the consequences of failure of piping segments. The methodology as approved for the WCAP TR may be expanded to include the augmented programs as described in the WCAP Addendum.

The staff review of the RI-ISI methodology in the WCAP TR determined that extension of the implementation of the RI-ISI methodology to piping in the augmented programs as described in the WCAP Addendum is not expected to affect existing safety analyses, meets the current regulations, is consistent with the defense-in-depth philosophy, maintains sufficient safety margins, provides reasonable assurance that risk increases (if any) resulting from the proposed change are small and consistent with the intent of the Commission's Safety Goal Policy

Statement, and will be monitored using performance-based strategies. Expansion of the applicable methodology as described in the WCAP Addendum does not affect the staff findings on the basic methodology. Details of the changes to the engineering analysis of the risk-informed evaluations that are needed during the application of the methodology to the welds in the augmented programs are discussed in the following sections.

4.2.1 Scope of Program

As discussed in the WCAP TR and in the staff's SE approving it, the staff has determined that full-scope and partial-scope options are acceptable for RI-ISI programs for piping. However, complete flexibility in selecting the scope was not accepted by the staff. Instead, the staff found that an acceptable scope definition must be based upon existing SSC classification such as ASME Section XI, Code Class. Piping designated as break exclusion in the plant-specific licensing basis is considered an acceptable SSC classification for defining the program scope.

Except for the BER program, augmented programs are targeted toward specific degradation mechanisms that may occur within any Class piping. The majority of BER program augmented exams are location dependent and generally associated with Class 2 piping systems. The WCAP TR methodology takes credit for inspections being performed by the augmented inspection programs when performing the failure probability calculations. Inclusion of the degradation specific augmented programs addressed in Section 2.0 above into the RI-ISI program, using the WCAP TR methodology in conjunction with the WCAP BER guidance, requires determination of the failure probabilities without ISI as discussed in Section 4.2.3 of this SE.

4.2.2 Piping Segments

Section 3.3 of the WCAP TR provides the definition for pipe segments. The definition of pipe segments is based on the manner that the segments are used in the approved methodology and not on any characteristics of the piping or degradation mechanisms that would preclude the application of the methodology to the augmented programs. The definition of piping segments will not change for the analysis described in the WCAP Addendum. The staff finds that the definition of segments based on the general characteristics outlined in the WCAP TR is sufficient and applicable to piping in the augmented programs.

4.2.3 Piping Failure Probability

The WCAP TR methodology is based on industry experience and the Structural Reliability and Risk Assessment (SRRA) computer code to determine the failure probabilities of piping segments. The WCAP methodology was applied to a pilot plant (Reference 4). The results indicate that the SRRA program can be used to estimate the failure frequency of the BER piping welds and the degradation mechanisms related to the other augmented inspection programs listed in the WCAP Addendum.

The SRRA program estimates the likelihood that a weld will fail, based in part, on the degradation mechanism(s) that the weld is exposed to and whether the weld is inspected or not inspected. The WCAP TR includes a number of guidelines specifying how the degradation

mechanism(s) and inspections are modeled in the SRRA program during the different phases of the RI-ISI program development. The WCAP TR guidelines for the evaluation of welds included in augmented inspection programs are different than for welds included only in the Section XI program. The WCAP TR specifies that the piping failure frequency models in the SRRA program reflect the presence of augmented programs that would remain unchanged by the RI-ISI program. The WCAP Addendum allows certain degradation specific augmented inspection programs to be treated the same as ASME Section XI program degradation mechanism(s) for inspections. When including piping segments that are part of an augmented inspection program that are being changed using the WCAP Addendum, the SRRA failure probabilities without ISI and without leak detection are used in the segment ranking risk evaluation, unless the segments are also inspected as part of an augmented inspection program that is not being changed.

During its review of the WCAP TR, the staff found that application of the guidelines appropriately identify the higher safety significant locations that should be inspected in the RI-ISI program. Therefore, the staff finds that application of these same guidelines in conjunction with the guidance in the WCAP Addendum to the subject augmented program degradation mechanism(s) and inspections is appropriate and acceptable.

4.2.4 Consequence of Failure

The consequences of the postulated pipe segment failures are considered in the WCAP TR and include direct and indirect effects of the failure. Direct effects include the loss of a train or system and associated possible diversion of flow or an initiating event, such as a loss-of-coolant accident (LOCA), or both. Indirect effects include dynamic effects arising from pipe whip or jet impingement and other spatial effects, such as from floods and spray, that may affect adjacent SSCs. It should be noted that the consequence of failure of the BER piping was not evaluated in the design and protected against in the same manner as for non-BER piping. Therefore, the evaluation as it relates to the determination of the potential dynamic effects is one of the principal differences between the methodology approved in the WCAP TR and the WCAP Addendum.

In the areas of the plant outside of the BER, high-energy pipe failures have been evaluated using the SRP guidelines and, if needed, mitigation devices were added. Because of the SRP Chapter 3.6.2 evaluation in areas of the plant outside of the BER, an evaluation of the potential consequences in support of RI-ISI as developed and documented by each licensee is sufficient to support the reduction and relocation of examination locations in the RI-ISI program. Within the BER however, pipe failures were excluded and mitigation devices such as pipe whip restraints and jet impingement shields were not constructed. Therefore, a detailed consequence evaluation comparable to or more conservative than that described in SRP Chapter 3.6.2 is needed to evaluate the impact of pipe failures more likely to affect containment integrity and the operability of nearby equipment due to the lack of mitigative hardware in the break exclusion region.

The criteria for the WCAP Addendum consequence evaluation are provided in Section 3.2 of the topical report. It includes criteria for postulating circumferential and longitudinal breaks at all possible locations along the high energy piping runs. It also includes criteria for evaluating the dynamic effects of pipe whip and jet impingement of these postulated pipe breaks on pipes,

and other structures and equipment. For example, an unrestrained whipping pipe is assumed to fail a smaller line and is considered capable of developing through-wall cracks in a line of the same size. In addition, the evaluation of fluid jets emanating from postulated breaks on nearby structures and components shall consider the effects of jet loading, fluid temperature, and moisture on the targets impinged upon. The WOG stated that the evaluation of pipe whip and jet impingement is consistent with BTP MEB 3-1, attached to SRP Chapter 3.6.2 and ANSI/ANS-58.2.

The staff finds that Section 3.2 of the WCAP Addendum provides clear guidance for evaluating the dynamic effects of postulated BER piping failures. Since this guidance is consistent with BTP MEB 3-1 and ANSI/ANS-58.2 previously approved by the staff to evaluate the effects of postulated pipe ruptures, the staff finds this guidance acceptable.

4.2.5 Probabilistic Risk Assessment

The scope, level of detail, and quality of a PRA and the general methodology for using PRA in regulatory applications is discussed in RG 1.174. RG 1.178 provides guidance that is more specific to ISI. The SE approving the WCAP TR states that individual applications in RI-ISI must address, in part, the quality, scope and level of detail of the PRA used.

During the review of 10 CFR 50.55a RI-ISI relief requests, the quality of the PRA is reviewed and, upon approval of the relief request, judged sufficient to support a RI-ISI application. The evaluations described in the WCAP Addendum may be used to modify an existing RI-ISI program and implement the modified program without staff review and approval. If an existing program is modified, the evaluation will use the PRA which has been reviewed and approved for use with the methodology, or a later revision of that PRA. As discussed in the WCAP TR, the RI-ISI program is a living program subject to periodic updates. There are no requirements for NRC staff review and approval of periodic updates before they are implemented. Instead, a list of information to be retained onsite for retrieval and potential NRC audit is provided. The staff finds that incorporating the augmented programs into the RI-ISI program as described in the WCAP Addendum is analogous to a periodic update and therefore no additional staff review and approval of the PRA quality is required.

The WCAP TR describes the approved methodologies for combining piping failure frequencies with PRA results to determine the safety-significance of the segments and to estimate the change in risk parameters that are compared to the acceptance guidelines. These methodologies are applicable to all piping and areas of the plant. The WCAP Addendum maintains these methodologies unchanged and includes additional acceptance guidelines that will be applied to changes in the BER program. The staff finds the continued use of the approved methodologies acceptable. The additional acceptance guidelines are discussed in Section 4.3 of this SE.

4.3 Integrated Decisionmaking

RG 1.178 and SRP Chapter 3.9.8 guidelines describe an integrated approach that should be utilized to determine the acceptability of the proposed RI-ISI program by considering in concert the traditional engineering analysis, risk evaluation, and the implementation and performance monitoring of piping under the program.

In the WCAP TR approach to integrated decisionmaking, conventional PRA results are combined with failure probabilities for piping segments to provide a quantitative measure of the safety significance of piping segments. The quantitative ranking is a relative ranking methodology where the importance of individual segments is determined by each segment's estimated risk contribution relative to the total estimated risk. Quantitative guidelines are provided indicating when an individual segment's contribution to the total estimated risk is great enough that the segment should be classified as high-safety-significant (HSS) and should be inspected. The quantitative results are reviewed by an expert panel which makes a final determination of the safety significance of each pipe segment by utilizing their expertise and past experience in inspection results, industry piping failure data, relative stress analysis results, PRA insights, and knowledge of ISI and nondestructive examination techniques.

An important characteristic of the modification to the ASME and most augmented programs is that inspections can be relocated from low-safety-significant (LSS) locations to HSS locations to partially or wholly offset increases in risk that might otherwise be expected with a reduction in the number of inspections. Currently, 100 percent of the BER welds are inspected. This percentage will be reduced with implementation of a risk-informed BER inspection program. The results of a pilot application of the methodology on a BER program (Reference 3) indicated that incorporation of BER piping into the RI-ISI program resulted in no BER segments being categorized HSS based on the quantitative guidelines in the WCAP TR. The pilot application was performed on a typical PWR, and substantially different results for other plants are not expected. LSS segments are not inspected in RI-ISI and therefore there is a high likelihood that no inspections would be performed in the BER in a RI-ISI program unless the expert panel selected some locations based on qualitative considerations.

The staff noted in the SE that approved the WCAP TR that, although a reduction in the number of welds inspected is anticipated, it is expected that there will be reasonable assurance that the program will provide a substantive ongoing assessment of piping condition. Reasonable assurance of a substantive ongoing program is provided, in part, by the initial selection of some inspection locations by a systemic evaluation, augmented by the expert panel's review. In order to maintain this characteristic of the original methodology, the WCAP Addendum states that additional screening based on the following guidelines will be performed on the BER piping. These additional guidelines provide additional decision criteria that support the selection of the highest safety significant locations within the BER for continued inspection in an RI-ISI program. Application of these guidelines to the pilot application resulted in inspections at eight locations (slightly more than 3 percent) from the original population of BER inspection locations:

> Individual segments whose contribution to core damage frequency (CDF) or large early release frequency (LERF) is greater than 1E-8/year or 1E-9/year respectively, will be classified as HSS.
>
> The expert panel will reclassify any BER piping segment that was initially classified as LSS to HSS, if the failure of that piping segment would result in a loss of more than one train of a mitigation function that is modeled in the PRA.
>
> If the number of risk-informed inspections in the BER piping is less than two percent of the total number of BER inspections performed in the region prior to the risk-informed evaluation, then the expert panel will request that additional

BER segments be added to the inspection program to reach a minimum sampling of two percent of the original BER program inspections.

The staff finds that, with the exception of the BER program, the WCAP TR's integrated decisionmaking methodology can appropriately evaluate the augmented programs listed in the WCAP Addendum and that incorporation of these programs within the scope of the RI-ISI program is acceptable. The staff finds that the use of the additional guidelines applied to the BER weld population is consistent with the sensitive location, lack of mitigative devices, and uncertainties in the methodologies used to rank the segments and estimate the change in risk and, therefore, is acceptable.

4.3.1 Selection of Examination Locations

Section 3.7 of the WCAP-TR addresses the guidelines to be used to determine the number of structural elements selected for examination, consistent with the safety significance and failure potential of the given pipe segment. The methodology provides guidance on selecting inspection locations in segments with and without degradation mechanisms. Consequently, the inspection locations selection process may be used unchanged.

4.3.2 Examination Methods

The evaluation of degradation mechanisms to determine the potential for piping failure is provided in Section 3.5 of the WCAP TR. The associated mechanism-specific examination volumes and methods for the selected piping structural elements are provided in Table 4.1-1 of the WCAP TR. This table is taken directly from Code Case N-577. Code Case N-577 has not been endorsed by the NRC staff and recent code work has focused on Appendix "X." The applicable table in Appendix "X" has been updated to require volumetric examination on HSS segments having primary water stress corrosion cracking (PWSCC) as their postulated degradation mechanism. Recent industry experience with dissimilar metal welds in a primary water environment provides justification for volumetric examinations.

These inspection volumes and methods approved by the staff for the WCAP-TR, are applicable to the BER zone because the materials, degradation mechanisms, and operating characteristics of this region are not inherently different between the BER and the balance of the plant. In addition, recent industry experience warrants additional focus on dissimilar metal welds in a primary water environment. The WCAP TR methodology provides for the incorporation of new industry experience through the feedback step in the methodology.

4.4 Implementation and Monitoring

The objective of this element of RGs 1.174 and 1.178 is to assess performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that confirm the assumptions and analysis used in developing the RI-ISI program. As specified in the WCAP TR approved by the staff, a licensee using this methodology will be expected to incorporate the results of its RI-ISI evaluation into plant-specific program procedures that are consistent with the performance-based implementation and monitoring strategies specified in RG 1.174 and, to the extent applicable, RG 1.178. The implementation and monitoring strategies approved by the staff remain unchanged by the WCAP Addendum.

The use of the WCAP TR, as supplemented by the WCAP Addendum, to determine the number of augmented inspections changes the inspection of welds from the current selection to a risk-informed selection. In order to make this change, the licensee must identify the appropriate change process to be used. If the augmented programs are described in the FSAR, the change process would be 10 CFR 50.59. In applying the evaluation criteria of 10 CFR 50.59 to this change, the use of the approved methodology in the WCAP TR, as supplemented by the WCAP Addendum, would not be a "departure from a method of evaluation" (and thus would not require prior approval) because it is a method approved by the NRC for the intended application. Proposed changes to augmented programs that are described in the FSAR and which are not governed by 10 CFR 50.55a may be changed with the appropriate use of the 10 CFR 50.59 process. If there are ASME Class 1 or Class 2 piping welds in the augmented programs' scope and the ASME XI inspections are being risk-informed for that piping (i.e., <25 percent for Class 1 and <7.5 percent for Class 2), then the licensee must still submit a relief request.

4.5 Conformance to Regulatory Guide 1.174

RG 1.174 describes an acceptable method for assessing the nature and impact of licensing basis changes by a licensee when the licensee chooses to support these changes with risk information. The staff found that the methodology described in WCAP TR conforms to the RG 1.174 approach.

Principle 1 states that the proposed change must meet current regulations unless it is explicitly related to a requested exemption or rule change. The WCAP Addendum does not modify the WCAP TR methodology in this regard and the staff discussions and findings for the WCAP TR remain applicable.

Principle 2 states that the proposed change must be consistent with the philosophy of defense-in-depth. Approval of the WCAP TR was conditioned on an expectation that there will be reasonable assurance that the program will provide a substantive ongoing assessment of piping condition. The WCAP Addendum provides additional qualitative guidelines that will be applied to the BER. These additional guidelines provide assurance that an ongoing assessment of the piping condition in the BER region will be maintained in an RI-ISI program. No additional guidelines are needed for the subject augmented programs that address specific degradation mechanisms listed in the WCAP Addendum.

Principle 3 states that the proposed change shall maintain sufficient safety margins. No changes to the evaluation of design basis accidents in the FSAR are being made by the RI-ISI process. In addition, the continued use of the statistical model in the WCAP TR provides confidence that safety margins (in terms of pipe failure probability) are maintained.

Principle 4 states that, when proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement. The expansion of the applicability of the WCAP TR methodology to include the augmented programs, except for the BER program, does not change any of the techniques or guidelines relied upon in the original methodology to conform to RG 1.174. Compared to the WCAP TR, the WCAP Addendum describes a more detailed description of the consequence evaluation and several additional acceptance criteria to be applied to the

evaluation of the BER piping. The addition of the consequence determination guidelines provides assurance that the risk evaluation is well-defined and systematic, consistent with the lack of mitigative devices in this region. The additional quantitative acceptance criteria address the large uncertainties of the risk estimates consistent with the sensitive location. Together, these guidelines provide confidence that Principle 4 is met.

Principle 5 states that the impact of the proposed change should be monitored using performance measurement strategies. The WCAP Addendum does not modify the WCAP TR methodology in this regard and the staff discussions and findings for the WCAP TR remain applicable.

5.0 CONCLUSIONS

The staff concludes that the proposed RI-ISI program as described in the WCAP TR and the WCAP Addendum, will provide an acceptable level of quality and safety with regard to the number of inspections, locations of inspections, and methods of inspections for augmented programs that are proposed to be incorporated into the RI-ISI program. The WCAP Addendum identifies the augmented programs that may be incorporated into the RI-ISI program. Augmented programs and ASME Section XI ISI requirements in piping that are not included in the scope of the RI-ISI evaluation shall remain unchanged.

The WCAP TR procedure for subdividing piping systems into segments is predicated on identifying portions of piping having the same consequences of failure and determining the failure potential for the piping. The impact on risk attributable to piping pressure boundary failure considers both direct and indirect effects. Consideration of direct effects includes failures that cause initiating events or disable single or multiple components, trains or systems, or a combination of these effects. The methodology described in the WCAP Addendum further defines the methods to be applied to determine the indirect consequences of pipe failures in the BER. Additional guidelines are included in the WCAP Addendum for application to the BER piping. These guidelines recognize that mitigation devices such as pipe whip restraints or jet impingement shields were not constructed in the plant design for BER piping. They also reflect the safety significance of ensuring the integrity of the containment and the operability of the isolation valves.

The WCAP TR, as applied to the augmented programs in the WCAP Addendum, provides the methodology for conducting an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth and quality are not degraded in that the methodology provides reasonable confidence that any reduction in existing inspections will not lead to degraded piping performance when compared to existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of system piping. Safety margins used in design calculations are not changed. Piping material integrity is monitored to ensure that aging and environmental influences do not significantly degrade the piping to unacceptable levels.

According to the methodology approved by the staff in the WCAP TR, licensees will identify those aspects of plant licensing bases that may be affected by the proposed change, including rules and regulations, the FSAR, technical specifications, and licensing conditions. In addition,

licensees will identify all changes to commitments that may be affected, as well as the particular piping systems, segments, and welds that are affected by the changes in the augmented programs. Specific revisions to inspection scope, schedules, locations, and techniques will also be identified, as will plant systems that rely on the affected piping.

As previously noted, changes to a licensee's augmented programs, as described in the FSAR, may be made under 10 CFR 50.59 if the evaluation criteria are met. Consistent with 10 CFR 50.59, if modification(s) to an augmented program, including the BER program, is made using the 10 CFR 50.59 process, the staff will not request any additional submittals. Changes to inspection locations caused by incorporation of the augmented programs into an existing RI-ISI program do not need to be submitted when the previously approved RI-ISI methodology is not modified. In accordance with the approved RI-ISI methodology, the staff expects the list of retrievable onsite documentation in Section 5.10 of the WCAP TR to be maintained by licensees that incorporate the augmented programs into a RI-ISI program.

Deviations from the NRC's approved methodology described in the WCAP TR or in the WCAP Addendum need to be identified and submitted to the staff for prior review and approval. A licensee that incorporates other NRC-mandated plant-specific augmented piping inspection programs (e.g., flow assisted corrosion) in an RI-ISI program other than those listed in Section 2.0 of the WCAP Addendum, shall submit to the NRC for review and approval a description of the program(s) and justification for incorporating the program(s) into the RI-ISI program.

6.0 REFERENCES

1. Letter from Louis F. Liberatori, Jr. (Chairman, Westinghouse Owners Group) to Steven Bloom (U. S. Nuclear Regulatory Commission), Inclusion of Augmented Inspection Programs into the WOG Risk-Informed ISI Program - WCAP-14572, Revision 1-NP-A, Addendum 1 (MUHP), December 21, 1999.

2. Letter from Karl Jacobs (Chairman, Westinghouse Owners Group) to Steven Bloom (U. S. Nuclear Regulatory Commission), Transmittal of Revised Pages for WCAP-14572, Revision 1-NP-A, "Addendum to Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report to Address Changes to Augmented Inspection Requirement" (Non-Proprietary) (MUHP-5200), June 2, 2000.

3. Letter from Robert H. Bryan (Chairman, Westinghouse Owners Group) to Chief, Information Management Branch, Division of Inspection and Support Programs, U. S. Nuclear Regulatory Commission, WOG Response to NRC Request for Additional Information to Support the Review of WCAP-14572, Revision 1-NP-A, Addendum 1-Markup, December 20, 2002.

4. Letter from Robert H. Bryan (Chairman, Westinghouse Owners Group) to Chief, Information Management Branch, Division of Inspection and Support Programs, U. S. Nuclear Regulatory Commission, Transmittal of WCAP-14572, Revision 1-NP-A, Addendum 1, Table 2-1, Changes to Address the NRC Request for Additional Inspection Screening Information, July 21, 2003.

5. WCAP-14572, Revision 1-NP-A, *Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report*, February 1999.

6. General Design Criterion 4 of 10 CFR Part 50, Appendix A, "Environmental and Dynamic Effects Design Bases."

7. Letter from J. F. O'Leary, Director of Licensing, USNRC, dated July 12, 1972.

8. Standard Review Plan Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," NUREG-0800, November 1975.

9. NRC Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping," September 1998.

10. Standard Review Plan Chapter 3.9.8, "Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping," NUREG-0800, September 1998.

11. NRC Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," July 1998.

12. Standard Review Plan Chapter 19.0, "Use of Probabilistic Risk Assessment in Plant-Specific, Risk-Informed Decisionmaking: General Guidance," NUREG-0800, July 1998.

13. NRC Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," November 2000.

Attachment: Resolution of Comments

Principal Contributors: S. Dinsmore
A. Keim

Date: March 1, 2004

RESOLUTION OF COMMENTS

ON DRAFT SAFETY EVALUATION FOR 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"

By letter dated January 21, 2004, the Westinghouse Owners Group (WOG) provided comments on the draft safety evaluation (SE) for Topical Report (TR) 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." The following is the staff's resolution of those comments.

1. Section 2.0, Regulatory Basis and Background

   The Westinghouse Owners Group (WOG) proposed the following clarification be added following the bulleted items:

   > The term "HELB exclusion area" as discussed in WCAP-14572, Revision 1-NP-A, Addendum 1 is the BER as addressed in SRP Chapters 3.6.1, 3.6.2, and 6.6.

   The NRC staff has fully incorporated this comment.

2. Section 2.0, Regulatory Basis and Background

   The WOG proposed the following be added to the discussion following the paragraph that reads "Although details of the BER design criteria were not provided…….. (3) the restraint is considered to be the terminal end break location."

   > The plant specific BER is described in the USAR.

   The NRC staff has fully incorporated this comment.

3. Section 4.1, Proposed Changes to the Augmented Programs – First Paragraph

   The WOG suggested the first sentence be revised to read as follows to avoid potential confusion with non-weld located structural inspections.

   > Licensees will identify, evaluate, and implement changes to the piping structural element inspection locations and the number of structural elements to inspect for the augmented programs listed in the WCAP Addendum based on the WCAP TR methodology as modified by the WCAP Addendum.

The NRC staff has fully incorporated this comment.

4. Section 4.2, Engineering Analysis – Second Paragraph, Last Sentence

The WOG suggested "risk-based" be replaced with "risk-informed."

The NRC staff has fully incorporated this comment.

5. Section 4.2.1, Scope of Program – First Paragraph

BER piping may consist of various classes of piping. The WOG suggested the following be added at the end of the last sentence.

> Piping designated as break exclusion in the plant specific licensing basis is considered an acceptable SSC designation for defining the program scope.

This comment has been fully incorporated by the NRC staff except that the term "SSC classification" is used instead of "SSC designation."

6. Section 4.2.1, Scope of Program – Second Paragraph

The text implies that break exclusion may not be subsumed into a Class 1 only program. The WOG suggested the following revision to the last sentence.

> …program may be necessary, to incorporate the BER program inspections into the RI-ISI program but is not required.

After considering the WOG comments, the NRC staff has decided to delete the entire sentence from the paragraph.

7. Section 4.2.1, Scope of Program – Third paragraph and Section 4.2.3, Piping Failure Probability – Second Paragraph

The text implies an additional requirement on failure probability that is not consistent with the requirements of the WCAP TR. The WOG suggested the text in Section 4.2.3 Piping Failure Probability – second paragraph at end of the last sentence be revised to read as follows:

> in the segment ranking risk evaluation, unless the segments are also inspected as part of an augmented inspection program that is not being changed.

The NRC staff has fully incorporated this comment.

8. Section 4.2.4, Consequence of Failure – First Paragraph, Last Sentence

The use of the word "consequences" could create confusion. The WOG suggested eliminating the word "consequences" as follows:

> Therefore, the evaluation as it relates to

The NRC staff has fully incorporated this comment.

9. Section 4.3.2, Examination Methods – First paragraph, Last Two Sentences

The text implies inspection options that are not consistent with approved RI-ISI methodologies. The WOG suggested deleting the last two sentences.

The NRC staff has fully incorporated this comment.

10. Section 5.0, Conclusions – Third Paragraph, Second Sentence

The WOG suggested replacing "is" with "are."

The NRC staff has fully incorporated this comment.

11. Section 5.0, Conclusions – Fourth Paragraph, Last Sentence

The last sentence appears to add a requirement for including a functional description that is not consistent with the WCAP TR and associated standard WOG NRC submittal template. The WOG suggested eliminating the reference to function and revise the sentence to read as follows:

> as will plant systems that rely on the affected piping.

The NRC staff has fully incorporated this comment.