

January 9, 2001

Mr. Carl Terry, BWRVIP Chairman  
Niagara Mohawk Power Company  
Post Office Box 63  
Lycoming, NY 13093

SUBJECT: ACCEPTANCE FOR REFERENCING OF "BWR VESSEL AND INTERNALS PROJECT, LPCI COUPLING INSPECTION AND FLAW EVALUATION GUIDELINES (BWRVIP-42)," EPRI TOPICAL REPORT TR-108726, AND "APPENDIX A, BWR LPCI COUPLING, DEMONSTRATION OF COMPLIANCE WITH THE TECHNICAL INFORMATION REQUIREMENTS OF THE LICENSE RENEWAL RULE (10 CFR 54.21)"

Dear Mr. Terry:

By letter dated December 11, 1997, as supplemented by letters dated September 8, 1998, and October 21, 1999, the Boiling Water Reactor Vessel and Internals Project (BWRVIP) submitted the Electric Power Research Institute (EPRI) proprietary Report TR-108726, "BWR Vessel and Internals Project, LPCI Coupling Inspection and Flaw Evaluation Guidelines (BWRVIP-42)," for NRC staff review and approval. The BWRVIP-42 report included an initial non-proprietary version, which was supplemented by an expanded non-proprietary version by letter dated March 23, 1999. Also included in the initial submittal was "Appendix A, BWR LPCI Coupling, Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR 54.21)," for staff review in accordance with the License Renewal Rule (10 CFR Part 54).

The BWRVIP-42 report contains generic guidelines to BWRVIP members on inspection and flaw evaluation of low pressure coolant injection (LPCI) couplings. These guidelines considered degradation susceptibility, degradation mechanisms, loads, and inspection strategies for LPCI couplings. The intent of the report is to provide an acceptable level of quality and inspection and flaw evaluation guidance to BWRVIP members that can be used to assure adequate BWR LPCI coupling integrity when meeting the specified acceptance criteria.

In response to the staff's request for additional information (RAI), dated April 14, 1998, the BWRVIP provided supplemental information by letter dated September 8, 1998. The NRC staff issued its initial safety evaluation report (SER) by letter dated June 14, 1999, which found the BWRVIP-42 report to be acceptable for inspection and assessment of the subject safety-related internal components, except where the staff's conclusions differed from the BWRVIP's, as discussed in the initial SE's open items. By letter dated October 21, 1999, the BWRVIP provided a response which proposed guidance to resolve the issues identified in the

January 9, 2001

staff's initial SE, modifying the BWRVIP-42 report. The staff issued a final SER (FSER) by letter dated May 26, 2000, which found the revised guidance of the BWRVIP-42 to be acceptable for the inspection and flaw evaluation of the subject internal components for the current operating period of BWRs.

As documented in the enclosed license renewal (LR) SE, the NRC staff has completed its review of the BWRVIP-42 report. As indicated in the LR SE, the staff found the BWRVIP-42 report acceptable for licensees participating in the BWRVIP to reference in a license renewal application to the extent specified and under the limitations delineated in the LR SE. In order for licensees participating in the BWRVIP to rely on the report, they must commit to the accepted aging management programs (AMPs) defined therein, and complete the action items described in the LR SE. By referencing the BWRVIP-42 report and the AMPs in it, and completing the action items, an applicant will provide sufficient information for the staff to make a finding that there is reasonable assurance that the applicant will adequately manage the effects of aging so that the intended functions of the reactor vessel internal components covered by the scope of the report will be maintained consistent with the current licensing basis during the period of extended operation.

The staff does not intend to repeat its review of the matters described in the report and found acceptable in the LR SE when the report is incorporated by reference in a LR application, except to ensure that the report's conclusions apply to the specified plant.

In accordance with the procedures established in NUREG-0390, "Topical Report Review Status," the staff requests that the BWRVIP publish the accepted version of BWRVIP-42 within 90 days after receiving this letter. In addition, the published version will incorporate this letter and the enclosed LR SE between the title page and the abstract.

To identify the version of the report that was accepted by the staff, the staff requests that the BWRVIP include "A" following the topical report number (e.g., BWRVIP-42-A).

Sincerely,

*/RA/*

Christopher I. Grimes, Branch Chief  
License Renewal and Standardization Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Project No. 704

Enclosure: Final Safety Evaluation Report

cc w/encl: See next page

staff's initial SE, modifying the BWRVIP-42 report. The staff issued a final SER (FSER) by letter dated May 26, 2000, which found the revised guidance of the BWRVIP-42 to be acceptable for the inspection and flaw evaluation of the subject internal components for the current operating period of BWRs.

As documented in the enclosed license renewal (LR) SE, the NRC staff has completed its review of the BWRVIP-42 report. As indicated in the LR SE, the staff found the BWRVIP-42 report acceptable for licensees participating in the BWRVIP to reference in a license renewal application to the extent specified and under the limitations delineated in the LR SE. In order for licensees participating in the BWRVIP to rely on the report, they must commit to the accepted aging management programs (AMPs) defined therein, and complete the action items described in the LR SE. By referencing the BWRVIP-42 report and the AMPs in it, and completing the action items, an applicant will provide sufficient information for the staff to make a finding that there is reasonable assurance that the applicant will adequately manage the effects of aging so that the intended functions of the reactor vessel internal components covered by the scope of the report will be maintained consistent with the current licensing basis during the period of extended operation.

The staff does not intend to repeat its review of the matters described in the report and found acceptable in the LR SE when the report is incorporated by reference in a LR application, except to ensure that the report's conclusions apply to the specified plant.

In accordance with the procedures established in NUREG-0390, "Topical Report Review Status," the staff requests that the BWRVIP publish the accepted version of BWRVIP-42 within 90 days after receiving this letter. In addition, the published version will incorporate this letter and the enclosed LR SE between the title page and the abstract.

To identify the version of the report that was accepted by the staff, the staff requests that the BWRVIP include "A" following the topical report number (e.g., BWRVIP-42-A).

Sincerely,

*/RA/*

Christopher I. Grimes, Branch Chief  
License Renewal and Standardization Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Project No. 704

Enclosure: Final Safety Evaluation Report

cc w/encl: See next page

DISTRIBUTION:  
See next page

Enclosed SER provided by memorandum from W. Bateman, EMCB, to C. Grimes, RLSB, dated December 1, 2000, Accession number ML003775001.

DOCUMENT NAME: G:\RLSB\ANAND\BWRIP-42.WPD

|        |          |              |              |          |              |            |
|--------|----------|--------------|--------------|----------|--------------|------------|
| OFFICE | LA:DRIP  | PM:RLSB:DRIP | BC:RLSB:DRIP | OGC      | D:DE         | D:DRIP     |
| NAME   | EGHylton | RKAnand      | CIGrimes     |          | JRStrosnider | DBMatthews |
| DATE   | 12/08/01 | 12/07/00     | 12/11/00     | 12/19/00 | 01/05/01     | 01/09/01   |

DISTRIBUTION:

**HARD COPY**

RLSB RF

E. Hylton

R. Anand

**E-MAIL:**

PUBLIC (ADAMS)

R. Zimmerman

J. Johnson

D. Matthews

C. Grimes

C. Carpenter

B. Zalcman

J. Strosnider

R. Wessman

G. Bagchi

M. Kanoly

W. Bateman

J. Calvo

C. Holden

P. Shemanski

J. Shea

G. Holahan

T. Collins

C. Gratton

B. Boger

J. Peralta

J. Moore

J. Rutberg

R. Weisman

J. Euchner

M. Mayfield

S. Bahadur

A. Murphy

W. McDowell

S. Droggitis

N. Dudley, ACRS

RLSB Staff

-----

L. Olshan

J. Vora

H. Berkow

S. Cahill

J. Wilson

C. Casto

C. Julian

FINAL LICENSE RENEWAL SAFETY EVALUATION REPORT  
BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
FOR  
“BWR VESSEL AND INTERNALS PROJECT, LPCI COUPLING  
INSPECTION AND FLAW EVALUATION GUIDELINES (BWRVIP-42),”  
EPRI TOPICAL REPORT TR-108726, DECEMBER 1997  
FOR COMPLIANCE WITH THE LICENSE RENEWAL RULE (10 CFR PART 54)

1.0 INTRODUCTION

1.1 Background

By letter dated December 11, 1997, as supplemented by letters dated September 8, 1998, and October 21, 1999, the Boiling Water Reactor Vessel and Internals Project (BWRVIP) submitted the Electric Power Research Institute (EPRI) proprietary Report TR-108726, “BWR Vessel and Internals Project, BWR LPCI Inspection and Flaw Evaluation Guidelines (BWRVIP-42),” for NRC staff review and approval. The BWRVIP-42 report included an initial non-proprietary version, which was supplemented by an expanded non-proprietary version by letter dated March 23, 1999. Also included was in the initial submittal was “Appendix A, BWR LPCI Coupling, Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR 54.21),” for staff review in accordance with the License Renewal Rule (10 CFR Part 54).

The BWRVIP-42 report contains generic guidelines to BWRVIP members on inspection and flaw evaluation of low pressure coolant injection (LPCI) couplings. These guidelines considered degradation susceptibility, degradation mechanisms, loads, and inspection strategies for LPCI couplings. The intent of the report is to provide an acceptable level of quality and inspection and flaw evaluation guidance to BWRVIP members that can be used to assure adequate BWR LPCI coupling integrity when meeting the specified acceptance criteria.

In response to the staff’s request for additional information (RAI), dated April 14, 1998, the BWRVIP provided supplemental information by letter dated September 8, 1998. The NRC staff issued its initial safety evaluation report (SER) by letter dated June 14, 1999, which found the BWRVIP-42 report to be acceptable for inspection and assessment of the subject safety-related internal components, except where the staff’s conclusions differed from the BWRVIP’s, as discussed in the initial SE’s open items. By letter dated October 21, 1999, the BWRVIP provided a response which proposed guidance to resolve the issues identified in the staff’s initial SE, modifying the BWRVIP-42 report. The staff issued a final SER (FSER) by letter dated May 26, 2000, which found the revised guidance of the BWRVIP-42 to be acceptable for the inspection and flaw evaluation of the subject internal components for the current operating period of BWRs.

Enclosure

## 1.2 Purpose

The staff reviewed the BWRVIP-42 report and its Appendix A to determine whether its guidance will provide acceptable levels of quality for inspection and flaw evaluation of the subject safety-related RPV internal components within the scope of the report during the period of extended operation. The staff also considered compliance with the LR Rule in order to allow applicants for renewal the option of incorporating the BWRVIP-42 guidelines by reference in a plant-specific integrated plant assessment (IPA) and associated time-limited aging analyses (TLAA).

Section 54.21 of the LR Rule requires, in part, that each application for license renewal contain an IPA and an evaluation of TLAA. The IPA must identify and list those structures and components subject to an aging management review and demonstrate that the effects of aging will be adequately managed so that their intended functions will be maintained consistent with the current licensing basis (CLB) for the period of extended operation. In addition, 10 CFR 54.22 requires that each application include any technical specification changes or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application.

If a LR applicant participating in the BWRVIP confirms that the BWRVIP-42 report applies to its facility and that the results of the Appendix A, IPA and TLAA evaluation are in effect at its plant, then no further review by the NRC staff of the issues described in the documents is necessary, except as specifically identified by the staff, below. With this exception, such an applicant may rely on the BWRVIP-42 report for the demonstration required by 10 CFR 54.21(a)(3) with respect to the components and structures within the scope of the report. Under such circumstances, the NRC staff intends to rely on the evaluation in this LR SE to make the findings required by 10 CFR 54.29 with respect to a particular application, except as necessary to ensure that the BWRVIP-42 report's conclusions apply to the specified plant.

## 1.3 Organization of Safety Evaluation Report

Because the BWRVIP-42 report, as supplemented and modified, is proprietary, this SE was written so as not to repeat information contained in the proprietary portions of the report. The staff does not discuss in any detail the proprietary provisions of the guidelines nor the parts of those guidelines it finds acceptable. A brief summary of the contents of the BWRVIP-42 report is given in Section 2.0 of this SE, with the NRC staff's evaluation presented in Section 3.0. The conclusions are summarized in Section 4.0. The presentation of the evaluation is structured according to the organization of the BWRVIP-42 report.

## 2.0 SUMMARY OF BWRVIP-42 REPORT

The BWRVIP-42 report and its Appendix A contain a generic evaluation of the management of the effects of aging on the subject RPV internal components such that their intended functions will be maintained consistent with the CLB for the period of extended operation. This evaluation applies to BWR applicants who have committed to implementing the BWRVIP-42 report and want to incorporate the report and Appendix A by reference into a plant-specific IPA and associated TLAA.

## 2.1 BWRVIP-42 Topics

The BWRVIP-42 report addresses the following topics in the following order:

- LPCI Coupling Design and Susceptibility Information - The LPCI coupling assemblies are described in detail by a series of illustrations and differences among the various models of BWRs (BWR/4, BWR/5, and BWR/6). The various types of LPCI coupling susceptibility factors and material degradation mechanisms (e.g., intergranular stress corrosion cracking - IGSCC, which has factors that include environment, materials and stress state; fatigue by flow induced vibration and/or thermal cycling; and, aging embrittlement) that could impact the LPCI couplings are described in general terms. Potential failure locations are addressed from the standpoint of inspection priority, susceptibility to degradation, and consequences of failures in terms of component functions and plant safety.
- Inspection Strategy - The BWRVIP-42 report recommends the specific locations, non-destructive examination (NDE) methods, and inspection frequencies for examinations of the LPCI coupling assemblies. The report also describes the inspection basis and methods, the recommended baseline inspection scope, the reinspection frequency, scope expansion, and reporting of inspection results.
- Loads and Load Combinations - The various types of loads (e.g., pressures, seismic, etc.) of concern are listed and load combinations are described.
- Flaw Evaluation Methodologies - This section presents methods which can be used to determine if observed flaws are acceptable from the structural integrity and leakage points of view. It describes flaw evaluations for the elbow/elbow extension welds and other weld locations and a leakage evaluation.

## 2.2 Identification of Structures and Components Subject to an Aging Management Review

10 CFR 54.21(a)(1) requires that an IPA identify and list those structures and components within the scope of license renewal that are subject to an aging management review. Structures and components subject to an aging management review are those structures and components that (1) perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties and (2) are not subject to replacement based on a qualified life or specified time period. These structures and components are also referred to as "passive" and "long-lived" structures and components.

Section 2.0 of the BWRVIP-42 report describes the intended function of the LPCI coupling, to provide a flow path between the reactor vessel thermal sleeve and the core shroud.

The BWRVIP-42 report's Appendix A identifies the passive and long-lived components as required by 10 CFR 54.21(a)(1). The BWRVIP-42 report states that all of the components in the LPCI coupling are passive and long lived and are subject to aging management review.

### 2.3 Effects of Aging

The BWRVIP identified the aging mechanisms and aging effects for the internals using the guidance from NUMARC 90-02, "BWR Reactor Pressure Vessel License Renewal Industry Report," Revision 1, dated August 1992. The BWRVIP also used NUREG-1557, "Summary of Technical Information and Agreements from Nuclear Management and Resources Council Industry Reports Addressing License Renewal," dated October 1996, to correlate the aging effects and their associated aging mechanisms. Using these reports, the BWRVIP determined that crack initiation and growth is the only aging effect that requires aging management review for the LPCI coupling.

In Section 2.0 of the BWRVIP-42 report, the BWRVIP discussed the causes of crack initiation and growth and provided a susceptibility assessment, and also discussed the susceptibility factors of environment, materials, and stress state. The BWRVIP discussed each of the LPCI coupling's potential cracking locations, determining that:

1. many locations in the LPCI coupling are subject to an aggressive environment and are within a region of high electrochemical corrosion potential (ECP);
2. LPCI coupling materials at locations where a heat affected zone or excessive cold work exists may be susceptible to crack initiation and growth due to stress corrosion cracking;
3. based on the configuration, most LPCI coupling components, regardless of the grade of material, are potentially susceptible to crack initiation and growth; and,
4. regions with the highest expected crack initiation and growth susceptibility are the creviced locations, especially those regions subject to high weld residual stresses.

Historically, visual inspections have been performed of the LPCI coupling in several plants and no indications or cracking have been found.

### 2.4 Aging Management Programs

10 CFR 54.21(a)(3) requires that the applicant demonstrate, for each component identified, that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB for the period of extended operation.

Section 3.0 of the BWRVIP-42 report discusses the inspection strategy to be used for ensuring that cracks that might occur in the LPCI coupling are detected in a timely manner. The inspection methods and implementing guidance addresses the:

- LPCI coupling locations that require inspection;
- Extent of baseline inspection for each location;
- Extent of reinspection for each location;
- Methodology for scope expansion should degradation be detected; and,
- Analysis methods to determine the need for corrective action if degradation is detected.

The BWRVIP committed to address development of the technology to inspect inaccessible welds and to have the individual LR applicant notify the NRC of actions planned. The staff accepted this commitment. The BWRVIP concluded that both its inspection program and plant-specific considerations will result in verification of the structural integrity, consistent with the CLB, for the subject RPV internal components.

## 2.5 Time-Limited Aging Analyses (TLAA)

10 CFR 54.21(1)(c) requires that each application for license renewal contain an evaluation of TLAA as defined in 10 CFR 54.3, and that the applicant shall demonstrate that:

- (i) The analyses remain valid for the period of extended operation;
- (ii) The analyses have been projected to the end of the period of extended operation; or
- (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The TLAA considered in the BWRVIP-42 report are those licensee calculations and analyses that:

- (1) involve the LPCI coupling;
- (2) consider the effects of aging;
- (3) involve time-limited assumptions defined by the current operating term;
- (4) were determined to be relevant by the licensee in making a safety determination;
- (5) involve conclusions or provide the basis for conclusions related to the capability of the LPCI coupling to perform its intended function; and,
- (6) are contained or incorporated by reference in the CLB.

With respect to the BWRVIP-42 report, if a plant-specific analysis, as identified by an applicant, meets all six of the above criteria, the analysis will be considered a TLAA for license renewal and evaluated by the applicant.

The crack growth rate applied in flaw evaluation methodologies may result in a plant specific TLAA issue. The BWRVIP-42 report established a bounding crack growth rate that has been previously accepted by the NRC; however, it states that a lower crack growth rate may be used, if justified and approved by the NRC. Accelerated crack growth rates due to fatigue either from low cycle thermal cycling or high cycle flow induced vibrations are not applicable, since the BWRVIP has shown that fatigue is not a significant degradation mechanism as supported by field experience and testing.

## 3.0 STAFF EVALUATION

The staff's FSER of the BWRVIP-42 report for the current operating term was transmitted by letter dated May 26, 2000, to Carl Terry, BWRVIP Chairman. The NRC staff determined that the contents and recommendations in the BWRVIP-42 report, when coupled with the BWRVIP's

responses to the specific information requests in the staff's April 14, 1999, RAI, and the open items in the staff's initial SE dated June 14, 1999, provides a sufficient and acceptable basis for performing examinations and evaluating postulated flaw indications for the subject safety-related BWR internal components. The NRC staff concluded that licensee implementation of the guidelines in the BWRVIP-42 report will provide an acceptable level of quality for inspection and flaw evaluation of the components addressed for the current operating term.

The staff has further reviewed the BWRVIP-42 report and its Appendix A to determine if it demonstrates that the effects of aging on the reactor vessel components within the scope of the report will be adequately managed so that the components' intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). This is the last step in the IPA described in 10 CFR 54.21(a).

Besides the IPA, 10 CFR Part 54 requires an evaluation of TLAA in accordance with 10 CFR 54.21(c). The staff reviewed the BWRVIP-42 report to determine if the TLAA covered by the report were evaluated for license renewal in accordance with 10 CFR 54.21(c)(1).

### 3.1 Structures and Components Subject to Aging Management Review (AMR)

The staff agrees that the LPCI coupling components are subject to an AMR because they perform intended functions without moving parts or without a change in configuration or properties, and are not subject to replacement based on a qualified life or specified time period. The staff concludes that BWR applicants for license renewal must identify the appropriate subject RPV internal components as subject to aging management to meet the applicable requirements of 10 CFR 54.21(a)(1).

### 3.2 Intended Functions

The staff agrees that the intended function of the LPCI coupling is as stated, to provide a flow path between the reactor vessel thermal sleeve and the core shroud.

### 3.3 Effects of Aging

The information necessary to demonstrate compliance with the requirements of the license renewal rule 10 CFR 54.21 is provided in Appendix A of the BWRVIP-42 report. The BWR Reactor Pressure Vessel Industry Report NUMARC 90-02, Revision 1, August 1992, and the resolution to the NRC's questions on that industry report were used to identify the aging mechanisms for the LPCI coupling. If the industry report concluded that the aging mechanism was significant then the aging mechanism was included in the aging management review. Using this methodology, it was determined that crack initiation and growth was the only aging effect that required aging management review.

Accordingly, NUREG-1557 states that crack initiation and growth are the aging effects that need to be considered. Although the LPCI coupling is not specifically addressed in the industry report, the mechanisms affecting the coupling are described and evaluated. NUREG-1557 establishes the correlation between the aging effects and their associated aging mechanisms. For the reasons stated in NUREG-1557, the staff agrees that crack initiation and growth is the only aging effect applicable to the LPCI coupling components.

### 3.4 Aging Management Programs (AMP)

The staff evaluated the BWRVIP's AMP to determine if it contains the following 10 elements constituting an adequate AMP for license renewal:

- (1) Scope of Program: The program contains preventative measures to mitigate SCC; inservice inspection (ISI) to monitor the effects of SCC on the intended function of the components, and repair and/or replacement as needed to maintain the ability to perform the intended function
- (2) Preventive Actions: Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines. Maintaining high water purity reduces susceptibility to SCC. Hydrogen additions are effective in reducing electrochemical (corrosion) potentials in the recirculation piping system, but are less effective in the core region. Noble metal additions, through a catalytic action, appear to increase the effectiveness of hydrogen additions in the core region.
- (3) Parameters Monitored or Inspected: Inspection and flaw evaluation are performed in accordance with BWRVIP guidelines, as approved by the NRC.
- (4) Detection of Aging Effects: Inspection in accordance with BWRVIP guidelines provides adequate assurance that degradation due to SCC is detected before any loss of the intended function of the LPCI coupling components.
- (5) Monitoring and Trending: The inspection schedule is in accordance with applicable approved BWRVIP guidelines and is adequate for timely detection of cracks. Scope of examination expansion and re-inspection beyond the baseline inspection are required if flaws are detected.
- (6) Acceptance Criteria: Any degradation is evaluated in accordance with the applicable approved BWRVIP guidelines.
- (7) Corrective Actions: The corrective actions proposed by the BWRVIP in the BWRVIP-56 report are under staff review.
- (8) & (9) Confirmation Process and Administrative Controls: Site QA procedures, review and approval processes and administrative controls are implemented in accordance with the requirements of Appendix B to 10 CFR 50 and will continue to be adequate for the license renewal period.
- (10) Operating Experience: The BWRVIP-42 report did not identify any crack indications found in LPCI couplings, but cracking has occurred in a number of vessel internal components. Weld regions are the most susceptible, although it is not clear whether this is due to sensitization and/or impurities associated with the welds or the high residual stresses in the weld regions.

The staff's FSER of the BWRVIP-42 report for the current operating term was transmitted by letter dated May 26, 2000, to Carl Terry, BWRVIP Chairman. For the reasons set forth in the FSER, the staff concluded that the inspection strategy and evaluation methodologies discussed in the BWRVIP-42 report are acceptable. Based on the implementation of the BWRVIP-42

inspection program, as revised, the staff finds that there is reasonable assurance that crack initiation and growth will be adequately managed such that the intended functions of the subject safety-related RPV internal components will be maintained consistent with the CLB for the period of extended operation.

### 3.5 Time Limited Aging Analyses (TLAA)

The BWRVIP-42 report did not find any of the six TLAA criteria listed in Section 2.5 to be applicable for license renewal for the LPCI coupling components. Therefore, the staff concludes that the BWRVIP-42 document does not contain any generic TLAA issues pertinent for the subject safety-related BWR internal components.

The staff concludes that the crack growth rate applied in flaw evaluation methodologies may result in a plant specific TLAA issue. The BWRVIP-42 report established a bounding crack growth rate that has been previously accepted by NRC; however, it states that a lower crack growth rate may be used, if justified and approved by the NRC. The staff agrees that accelerated crack growth rates due to fatigue either from low cycle thermal cycling or high cycle flow induced vibrations are not applicable, since the BWRVIP-42 report has shown that fatigue is not a significant degradation mechanism based on field experience and testing.

## 4.0 CONCLUSIONS

The staff has reviewed the BWRVIP-42 report. On the basis of its review, as set forth above, the staff concludes that the BWRVIP-42 report provides an acceptable demonstration that the BWRVIP member utilities referencing this report will adequately manage the aging effects of reactor vessel components within the scope of the report, with the exception of the noted renewal applicant action items set forth in Section 4.1, below, so that there is reasonable assurance that the LPCI coupling will perform its intended functions in accordance with the CLB during the period of extended operation. The staff also concludes that, upon completion of the renewal applicant action items, the BWRVIP-42 report provides an acceptable evaluation of time-limited aging analyses for the LPCI coupling for the BWRVIP member utilities for the period of extended operation.

Any BWR utility may reference this report in a license renewal application to satisfy the requirements of (1) 10 CFR 54.21(a)(3) for demonstrating that the effects of aging on the LPCI couplings will be adequately managed and (2) 10 CFR 54.21(c)(1) for demonstrating the appropriate findings regarding evaluation of time-limited aging analyses for the LPCI coupling for the period of extended operation. The staff also concludes that, upon completion of the renewal applicant action items set forth in Section 4.1, below, referencing the BWRVIP-42 report and its Appendix A in a license renewal application and summarizing in an FSAR supplement the aging management programs and the TLAA evaluations contained in this report will provide the staff with sufficient information to make the findings required by Sections 54.29(a)(1) and (a)(2) for components within the scope of this report.

### 4.1 Renewal Applicant Action Items

The following are license renewal applicant action items to be addressed in the plant-specific license renewal application when incorporating the BWRVIP-42 report in a renewal application:

- (1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-42 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-42 report to manage the effects of aging on the functionality of the LPCI coupling during the period of extended operation, including actions planned to inspect welds that are presently inaccessible. If corrective actions are necessary, the applicant shall either commit to follow the guidance in the staff- approved BWRVIP-56 report, "LPCI Coupling Repair Design Criteria," or describe the process that will be utilized to repair the LPCI couplings, if needed. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-42 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).
- (2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-42 report for the LPCI coupling internals shall ensure that the programs and activities specified as necessary in the BWRVIP-42 report are summarily described in the FSAR supplement.
- (3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-42 report, the BWRVIP stated that there are no generic changes or additions to technical specifications associated with the LPCI coupling as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-42 report for the LPCI coupling internals shall ensure that the inspection strategy described in the BWRVIP-42 report does not conflict with or result in any changes to their technical specifications. If technical specification changes do result, then the applicant must ensure that those changes are included in its application for license renewal.
- (4) Applicants referencing the BWRVIP-42 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components. This is discussed in more detail in Section 2.5 of this SE.
- (5) The BWRVIP committed to address development of the technology to inspect inaccessible welds and to have the individual LR applicant notify the NRC of actions planned. Applicants referencing the BWRVIP-42 report for license renewal should identify this action as open and to be addressed once the BWRVIP's response to this issue has been reviewed and accepted by the staff.

## 5.0 REFERENCES

1. NUREG-1557, Summary of Technical Information and Agreements from Nuclear Management and Resources Council Industry Reports Addressing License Renewal, October 1996.
2. Carl Terry, BWRVIP, to USNRC, "BWR Vessel and Internals Project, LPCI Coupling Inspection and Flaw Evaluation Guidelines (BWRVIP-42)," EPRI Report TR-108726, dated December 1997.
3. C. E. Carpenter, USNRC, to Carl Terry, BWRVIP, "Propriety Request for Additional Information - Review of BWR Vessel and Internals Project Report, "BWR Vessel and Internals Project, LPCI Coupling Inspection and Flaw Evaluation Guidelines (BWRVIP-42)," (TAC No. MA1104), dated April 18, 1998.
4. Carl Terry, BWRVIP, to Carpenter, C.E., USNRC, "BWRVIP Response to NRC Safety Evaluation of BWRVIP-42" dated October 21, 1999.
5. J. R. Strosnider, USNRC, to Carl Terry, BWRVIP, "Safety Evaluation of BWR Vessel and Internals Project Report, LPCI Coupling Inspection and Flaw Evaluation Guidelines (BWRVIP-42), EPRI Report TR-108726," dated June 14, 1999.
6. J. R. Strosnider, USNRC, to Carl Terry, BWRVIP, "Final Safety Evaluation of BWR Vessel and Internals Project Report, LPCI Coupling Inspection and Flaw Evaluation Guidelines (BWRVIP-42), EPRI Report TR-108726," dated May 26, 2000.

cc:

Karl W. Singer, Executive Chair  
BWRVIP Assessment Task  
Tennessee Valley Authority  
PO Box 2000  
Decatur, AL 35602-2000

Bill Eaton, Executive Chair  
Inspection Committee  
Entergy Operations, Inc.  
PO Box 756, Waterloo Rd  
Port Gibson, MS 39150-0756

H. Lewis Sumner, Executive Chairman  
BWRVIP Mitigation Task  
Southern Nuclear Operating Co.  
M/S BIN B051, PO Box 1295  
40 Inverness Center Parkway  
Birmingham, AL 35201

Harry P. Salmon, Executive Chairman  
BWRVIP Integration Task  
New York Power Authority  
123 Main St., M/S 11 D  
White Plains, NY 10601-3104

George T. Jones, Executive Chair  
BWRVIP Repair Task  
Pennsylvania Power & Light, Inc.  
M/S GEN A 61  
2 N 9<sup>th</sup> Street  
Allentown, PA 18101-1139

Robert Carter, EPRI BWRVIP  
Assessment Manager  
EPRI NDE Center  
P. O. Box 217097  
1300 W. T. Harris Blvd.  
Charlotte, NC 28221

Greg Selby, EPRI BWRVIP  
Inspection Manager  
EPRI NDE Center  
P. O. Box 217097  
1300 W. T. Harris Blvd.  
Charlotte, NC 28221

Joe Hagan, BWRVIP Vice Chairman  
PECO Energy Co.  
MC 62C-3  
965 Chesterbrook Blvd  
Wayne, PA 19807-5691

Steve Lewis, Technical Chairman  
BWRVIP Assessment Task  
Entergy  
P. O. Box 756  
Waterloo Road  
Port Gibson, MS 39150

Carl Larsen, Technical Chairman  
BWRVIP Inspection Task  
Yankee Atomic  
580 Main Street  
Bolton, MA 01740

John Wilson, Technical Chairman  
BWRVIP Mitigation Task  
Clinton Power Station, M/C T-31C  
P.O. Box 678  
Clinton, IL 61727

Vaughn Wagoner, Technical Chairman  
BWRVIP Integration Task  
Carolina Power & Light Company  
One Hannover Square 9C1  
P.O. Box 1551  
Raleigh, NC 27612

Bruce McLeod, Technical Chairman  
BWRVIP Repair Task  
Southern Nuclear Operating Co.  
Post Office Box 1295  
40 Inverness Center Parkway  
Birmingham, AL 35201

Tom Mulford, EPRI BWRVIP  
Integration Manager  
Raj Pathania, EPRI BWRVIP  
Mitigation Manager  
Ken Wolfe, EPRI BWRVIP  
Repair Manager  
Electric Power Research Institute  
P. O. Box 10412  
3412 Hillview Ave.  
Palo Alto, CA 94303

James P. Pelletier, BWRVIP Liaison  
to EPRI Nuclear Power Council  
Nebraska Public Power District  
1200 Prospect Avenue  
PO Box 98  
Brownville, NE 683210098