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TECHNICAL EVALUATION OF INTEGRITY OF THE BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2 REACTOR COOLANT BOUNDARY PIPING SYSTEM

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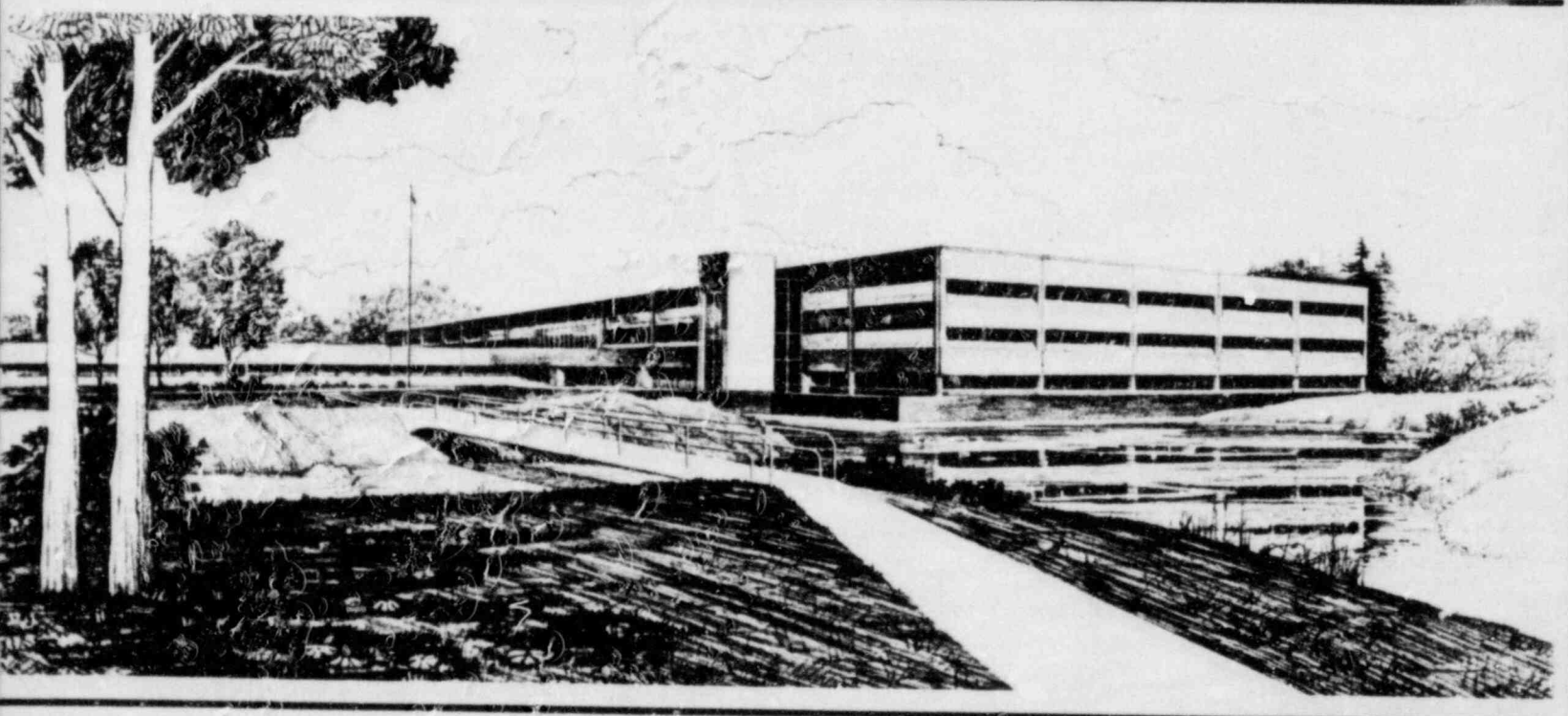
Idaho National Engineering Laboratory
Operated by the U.S. Department of Energy



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ABSTRACT

NUREG-0313, Rev. 1, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping, is the NRC staff's revised acceptable methods to reduce intergranular stress corrosion cracking in boiling water reactors. The responses to NRC Generic Letter 81-04 of the Carolina Power and Light Company concerning whether its Brunswick Steam Electric Plant Units 1 and 2 meet NUREG-0313, Rev. 1 are evaluated by EG&G Idaho, Inc. in this report. Particular attention was given the leak detection systems described in Regulatory Guide 1.45, Reactor Coolant Pressure Boundary Leak Detection Systems, referenced by Parts IV.B.1.a.(1) and (2) found on pages 7 and 8 of NUREG-0313, Rev. 1.

FOREWORD

This report is supplied as part of the Selected Operating Reactor Issues Program being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing, by EG&G Idaho, Inc., Materials Engineering Branch.

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SUMMARY

NUREG-0313, Rev. 1, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping, is the NRC staff's revised acceptable methods to reduce intergranular stress corrosion cracking in boiling water reactors. The responses to NRC Generic Letter 81-04 of the Carolina Power and Light Company concerning whether its Brunswick Steam Electric Plant Units 1 and 2 meet NUREG-0313, Rev. 1 are evaluated by EG&G Idaho, Inc. in this report. Particular attention was given the leak detection systems described in Regulatory Guide 1.45, Reactor Coolant Pressure Boundary Leak Detection Systems, referenced by Parts IV.B.1.a.(1) and (2) found on pages 7 and 8 of NUREG-0313, Rev. 1.

As may be observed in the following table, Brunswick 1 and 2 do not meet any of the parts of NUREG-0313, Rev. 1 evaluated in this document.

The following table is a synopsis of the EG&G Idaho, Inc. evaluation of the Carolina Power and Light Company's response to NRC Generic Letter 81-04.

Part of NUREG-0313, Rev. 1 Evaluated	Evaluation[a]	Additional Data Required[b]	Discrepancy
Section II.			
II.C.	Provides alternative to NUREG-0313, Rev. 1	No	Minor
Section III.			
Section IV.			
IV.B.	Does not meet NUREG-0313, Rev. 1	No	Minor
IV.B.1.a.(1)	Does not meet NUREG-0313, Rev. 1	Yes	Major
IV.B.1.a.(2)	Does not meet NUREG-0313, Rev. 1	Yes	Major
IV.B.1.b.	Provides alternative to NUREG-0313, Rev. 1	Yes	Minor
IV.B.1.b.(3)	Did not provide data in response to NRC Generic Letter 81-04	Yes	Minor
IV.B.1.b.(4)	Did not provide data in response to NRC Generic Letter 81-04	Yes	Minor

Part of NUREG-0313, Rev. 1 Evaluated	Evaluation[a]	Additional Data Required[b]	Discrepancy
IV.B.2.a.	The comments for Parts IV.B.1.a.(1) and IV.B.1.a.(2) apply here.		
IV.B.2.b.	Provides alternative to NUREG-0313, Rev. 1	Yes	Minor
IV.B.2.b.(6)	Did not provide data in response to NRC Generic Letter 81-04	Yes	Minor
Section V.			

[a]See Tables 1 and 3 for additional information.

[b]See Tables 1 and 4 for additional information.

CONTENTS

TABLES

TECHNICAL EVALUATION OF INTEGRITY OF THE BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2 REACTOR COOLANT BOUNDARY PIPING SYSTEM

1. INTRODUCTION

Intergranular stress corrosion cracking (IGSCC) of austenitic stainless steel (SS) piping has been observed in boiling water reactors (BWRs) since December 1965.[1] The NRC established a Pipe Crack Study Group (PCSG) in January 1975 to study the problem.[2] The PCSG issued two documents, NUREG-75/067 Technical Report, Investigation and Evaluation of Cracking in Austenitic Stainless Steel Piping of Boiling Water Reactors[3] and an implementation document, NUREG-0313, Rev. 0.[2] After cracking in large-diameter piping was discovered for the first time in the Duane Arnold BWR in 1978, a new PCSG was formed. The new PCSG in turn issued two reports, NUREG-0531, "Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants"[4] and NUREG-0313, Rev. 1, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping.[5] NUREG-0313, Rev. 1 is the implementing document of NUREG-0531 and discusses the augmented inservice inspection (ISI) and leak detection requirements "for plants that cannot comply with the material selection, testing, and processing guidelines" of NUREG-0313, Rev. 1.[5]

NRC Generic Letter 81-04 requested each licensee "to review all ASME Code Class 1 and 2 pressure boundary piping, safe ends, and fitting material, including weld metal to determine if (they) meet the material selection, testing and processing guidelines in" NUREG-0313, Rev. 1.[6] The generic letter offered the option of providing a description, schedule, and justification for alternative actions that would reduce the susceptibility of pressure boundary piping and safe ends to intergranular stress corrosion cracking (IGSCC) or increase the probability of early detection of leakage from pipe cracks.

In response to NRC Generic Letter 81-04, the Carolina Power and Light Company (CP&L) submitted a letter on July 7, 1981.[7] A request for information from the NRC staff elicited another letter from CP&L on February 8, 1983.[8] EG&G Idaho personnel evaluated these responses, and this report provides:

1. A brief summary of the licensee's response to each part of NUREG-0313, Rev. 1.

2. A discussion of areas where the licensee does not meet the guidelines or requirements of NUREG-0313, Rev. 1.[a]

3. A brief discussion of the licensee's proposed alternatives to NUREG-0313, Rev. 1; however, no determination of acceptability is made on these alternatives.

4. An identification of all areas where the licensee has not provided sufficient information to judge the licensee's program.

There is an effort underway to revise NUREG-0313, Rev. 1 by NRC in light of research on IGSCC and recent instances of IGSCC at Nine Mile Point (March 1982) and Monticello (October 1982). Because of this contemplated revision of NUREG-0313, Rev. 1, the following issues will not be evaluated.

1. The licensee's proposed Technical Specifications[9] to implement the requirements, with the exception of the leak detection requirements in NUREG-0313, Revision 1, Sections IV.B.1.(a)(1) and IV.B.1.(a)(2).

2. The acceptability of licensee-proposed augmented inservice inspection (ISI) sampling criteria.

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a. Part III of NUREG-0313, Rev. 1 contains guidelines; Part IV contains requirements.

3. Credit for past operating experience and inspection results.

4. The acceptability of induction heating stress improvement (IHSI), heat sink welding (HSW), and weld overlay as alternates to augmented ISI.

2. EVALUATION

2.1 NUREG-0313, Rev. 1 Guidelines

The guidelines and requirements outlined in NUREG-0313, Rev. 1 form the basis of this evaluation. The NUREG-0313, Rev. 1 guidelines are found in Parts III and V and the requirements in Parts II and IV of that document. Part II discusses implementation of material selection, testing, and processing guidelines. Part III summarizes acceptable methods to minimize IGSCC susceptibility with respect to the material selection, testing, and processing guidelines. Part IV deals with leak detection and inservice inspection requirements of nonconforming (i.e., not meeting the guidelines of Part III of NUREG-0313, Rev. 1) piping. Part V discusses general recommendations.

2.2 Discussion of Tables

Table 1 has the complete text Parts II through V of NUREG-0313, Rev. 1 on the left side so that the reader may be able to refer to it as the topics are discussed. The right side summarizes the licensee's responses, lists the differences between the licensee's proposed implementation program and NUREG-0313, Rev. 1, and identifies the additional data required to evaluate the licensee's response.

Many sections in Parts II through IV of NUREG-0313, Rev. 1 are not discussed in the right hand column. In these cases, one of the comments below will be used.

- Not applicable because the construction permit for this plant has been issued.
- Not applicable because the operating license for this plant has been issued.
- Not applicable because the plant has been constructed.

- The licensee has not furnished data on this topic in his responses to NRC Generic Letter 81-04.

- No comment made because alternative plans were not evaluated.

Table 2 lists the summaries of the licensee's responses to NRC questions on implementation of NUREG-0313, Rev. 1 guidelines. Therefore, in Table 2 the reader is able to read all the summaries in one table without having to search Table 1 for all the summaries. The same compilation applies to Tables 3 and 4. Table 3 lists the differences between the licensee's proposed implementation program and that recommended in NUREG-0313, Rev. 1. Table 4 lists the areas where additional information is required to properly evaluate the licensee's proposed implementation program. All the items in Tables 2, 3, and 4 are listed in their respective tables in the order they appear in Table 1.

2.3 Discrepancies

Any alternate proposal that did not meet a specific guideline or requirement of NUREG-0313, Rev. 1 was considered a discrepancy. Evaluation of alternate proposals was outside the scope of this task, as indicated in Section 1 of this report. Licensees have submitted definitions of "nonservice sensitive" and augmented ISI proposals that differ from NUREG-0313, Rev. 1. These differences are considered minor because the NRC staff is considering major modifications to those requirements. An example of a minor discrepancy is the use of the stress rule index (SRI) to choose which welds would be subjected to augmented ISI.

If the alternate proposal to leak detection does not meet the requirements in NUREG-0313, Rev. 1, it was considered a major discrepancy because NRC is not considering major modifications to those requirements. An example of a major discrepancy is a licensee's not proposing Technical Specifications to implement leak detection requirements in NUREG-0313, Rev. 1.

Only major discrepancies are listed in the Conclusions section.

3. CONCLUSIONS

Brunswick 1 and 2 have the following major discrepancies:

IV.B.1.a.(1) Leak Detection and Monitoring Systems

CP&L's description of the Brunswick 1 and 2 leak detection methods are not detailed enough to evaluate compliance with Section C of Regulatory Guide 1.45.

IV.B.1.a.(2) Leak Detection Requirements

CP&L has included a provision for shutdown for a 2-gpm increase in unidentified leakage in 24 h in the Brunswick 1 and 2 Technical Specifications.

However CP&L has not included provisions that fully meet NUREG-0313, Rev. 1.

There are minor discrepancies as well as the major ones listed above. These minor discrepancies are not listed here. However, while the licensee's alternate proposals that have been classified as minor discrepancies might be acceptable under the anticipated revision of NUREG-0313, Rev. 1, it should not be inferred that approval of those alternate proposals has been given.

The licensee has not supplied sufficient information to evaluate his responses to topics IV.B.1.a.(1), IV.B.1.a.(2), IV.B.1.b., IV.B.1.b.(3), IV.B.1.b.(4), IV.B.2.a., IV.B.2.b., and IV.B.2.b.(6). Table 4 lists the required information for each topic.

TABLE 1. REVIEW OF LICENSEE'S RESPONSE TO NRC GENERIC LETTER 81-04

Excerpts from NUREG-0313, Rev. 1

II. IMPLEMENTATION OF MATERIAL SELECTION, TESTING, AND PROCESSING GUIDELINES

II.A. For plants under review, but for which a construction permit has not been issued, all ASME Code Class 1, 2, and 3 lines should conform to the guidelines stated in Part III.

II.B. For plants that have been issued a construction permit but not an operating license, all ASME Code Class 1, 2, and 3 lines should conform to the guidelines stated in Part III unless it can be demonstrated to the staff that implementing the guidelines of Part III would result in undue hardship. For cases in which the guidelines of Part III are not complied with, additional measures should be taken for Class 1 and 2 lines in accordance with the guidelines stated in Part IV of this document.

II.C. For plants that have been issued an operating license, NRC designated "Service Sensitive" lines (Part IV. B) should be modified to conform to the guidelines stated in Part III, to the extent practicable. When "Service Sensitive" and other Class 1 and 2 lines do not meet the guidelines of Part III, additional measures should be taken in accordance with the guidelines stated in Part IV of this document. Lines that experience cracking during service and require replacement should be replaced with piping that conforms to the guidelines stated in Part III.

III. SUMMARY OF ACCEPTABLE METHODS TO MINIMIZE CRACK SUSCEPTIBILITY--MATERIAL SELECTION, TESTING, AND PROCESSING GUIDELINES

EG&G Idaho Evaluation--BRUNSWICK STEAM ELECTRIC

A. Not applicable because the construction permits for these plants have been issued.

B. Not applicable because the operating licenses for these plants have been issued.

C. SUMMARY

Carolina Power and Light (CP&L) will replace or repair affected lines if IGSCC is found during augmented ISI and has provided an alternative to NUREG-0313, Rev. 1.

DIFFERENCES

NUREG-0313, Rev. 1 requires that nonconforming NRC-designated "service sensitive" lines be replaced with corrosion-resistant materials. Also, lines that experience cracking should be replaced with corrosion-resistant materials.

CP&L has indicated they will replace or repair affected lines if IGSCC is found during augmented ISI.[7]

ADDITIONAL DATA REQUIRED

None.

III.A. Selection of Materials

Only those materials described in Parts 1 and 2 below are acceptable to the NRC for installation in BWR ASME Code Class 1, 2, and 3 piping systems. Other materials may be used when evaluated and accepted by the NRC.

A. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04. See comment on Part II.C. above.

III.A.1. Corrosion-Resistant Materials

All pipe and fitting material including safe ends, thermal sleeves, and weld metal should be of a type and grade that has been demonstrated to be highly resistant to oxygen-assisted stress corrosion in the as-installed condition. Materials that have been so demonstrated include ferritic steels, "Nuclear Grade" austenitic stainless steels,* Types 304L and 316L austenitic stainless steels, Type CF-3 cast stainless steel, Types CF-8 and CF-8M cast austenitic stainless steel with at least 5% ferrite, Type 308L stainless steel weld metal, and other austenitic stainless steel weld metal with at least 5% ferrite content. Unstabilized wrought austenitic stainless steel without controlled low carbon has not been so demonstrated except when the piping is in the solution-annealed condition. The use of such material (i.e., regular grades of Types 304 and 316 stainless steels) should be avoided. If such material is used, the as-installed piping including welds should be in the solution-annealed condition. Where regular grades of Types 304 and 316 are used and welding or heat treatment is required, special measures, such as those described in Part III.C, Processing of Materials, should be taken to ensure that IGSCC will not occur. Such measures may include (a) solution annealing subsequent to the welding or heat treatment, and (b) weld cladding of materials to be welded using procedures that have been demonstrated to reduce residual stresses and sensitization of surface materials.

1. The comments on III.A. also apply here.

*These materials have controlled low carbon (0.02% max) and nitrogen (0.1% max) contents and meet all requirements, including mechanical property requirements, of ASME specification for regular grades of Type 304 or 316 stainless steel pipe.

III.A.2. Corrosion-Resistant Safe Ends and Thermal Sleeves

All unstabilized wrought austenitic stainless steel materials used for safe ends and thermal sleeves without controlled low carbon contents (L-grades and Nuclear Grade) should be in the solution-annealed condition. If as a consequence of fabrication, welds joining these materials are not solution annealed, they should be made between cast (or weld overlaid) austenitic stainless steel surfaces (5% minimum ferrite) or other materials having high resistance to oxygen-assisted stress corrosion. The joint design must be such that any high-stress areas in unstabilized wrought austenitic stainless steel without controlled low carbon content, which may become sensitized as a result of the welding process, is not exposed to the reactor coolant. Thermal sleeve attachments that are welded to the pressure boundary and form crevices where impurities may accumulate should not be exposed to a BWR coolant environment.

2. The comments on III.A. also apply here.

III.B. Testing of Materials

For new installation, tests should be made on all regular grade stainless steels to be used in the ASME Code Class 1, 2, and 3 piping systems to demonstrate that the material was properly annealed and is not susceptible to IGSCC. Tests that have been used to determine the susceptibility of IGSCC include Practices A* and E** of ASTM A-262, "Recommended Practices for Detecting Susceptibility to Intergranular Attack in Stainless Steels" and the electrochemical potentiokinetic reactivation (EPR) test. The EPR test is not yet accepted by the NRC. If the EPR test is used, the acceptance criteria applied must be evaluated and accepted by the NRC on a case-by-case basis.

B. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04.

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*Practice A--Oxalic acid etch test for classification of etch structures of stainless steels.

**Practice E--Copper-copper sulfate-sulfuric acid test for detecting susceptibility to intergranular attack in stainless steels.

III.C. Processing of Materials

Corrosion-resistant cladding with a duplex microstructure (5% minimum ferrite) may be applied to the ends of Type 304 or 316 stainless steel pipe for the purpose of avoiding IGSCC at weldments. Such cladding, which is intended to (a) minimize the HAZ on the pipe inner surface, (b) move the HAZ away from the highly stressed region next to the attachment weld, and (c) isolate the weldment from the environment, may be applied under the following conditions:

C. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04. See comments on Part II.C. above.

III.C.1. For initial construction, provided that all of the piping is solution annealed after cladding.

1. The comments on III.C. also apply here.

III.C.2. For repair welding and modification to in-place systems in operating plants and plants under construction. When the repair welding or modification requires replacement of pipe, the replacement pipe should be solution-annealed after cladding. Corrosion-resistant cladding applied in the "field" (i.e., without subsequent solution annealing of the pipe) is acceptable only on that portion of the pipe that has not been removed from the piping system. Other "field" applications of corrosion-resistant cladding are not acceptable.

2. The comments on III.C. also apply here.

Other processes that have been found by laboratory tests to minimize stresses and IGSCC in austenitic stainless steel weldments include induction heating stress improvement (IHSI) and heat sink welding (HSW). Although the use of these processes as an alternate to augmented inservice inspection is not yet accepted by the NRC, these processes may be permissible and will be considered on a case-by-case basis provided acceptable supportive data are submitted to the NRC.

IV. INSERVICE INSPECTION AND LEAK DETECTION REQUIREMENTS FOR BWRs WITH VARYING DEGREES OF CONFORMANCE TO MATERIAL SELECTION, TESTING, AND PROCESSING GUIDELINES

IV.A. For plants whose ASME Code Class 1, 2, and 3 pressure boundary piping meets the guidelines of Part III, no augmented inservice inspection or leak detection requirements beyond those specified in the 10 CFR 50.55a(g), "Inservice Inspection Requirements" and plant Technical Specifications for leakage detection are necessary.

A. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04.

IV.B. ASME Code Class 1 and 2 pressure boundary piping that does not meet guidelines of Part III is designated "Nonconforming" and must have additional inservice inspection and more stringent leak detection requirements. The degree of augmented inservice inspection of such piping depends on whether the specific "Nonconforming" piping runs are classified as "Service Sensitive." The "Service Sensitive" lines were and will be designated by the NRC and are defined as those that have experienced cracking of a generic nature, or that are considered to be particularly susceptible to cracking because of a combination of high local stress, material condition, and high oxygen content in the relatively stagnant, intermittent, or low-flow coolant. Currently, for the nonconforming ASME Code Class 3 piping, no additional inservice inspection beyond the Section XI visual examination is required.

Examples of piping considered to be "Service Sensitive" include but are not limited to: core spray lines, recirculation riser lines,* recirculation bypass lines (or pipe extensions/stub tubes on plants where the bypass lines have been removed), control rod drive (CRD) hydraulic return lines, isolation condenser lines, recirculation inlet lines at safe ends where crevices are formed by the welded thermal sleeve attachments, and shutdown heat exchanger lines. If cracking should later be found in a particular piping run and considered to be generic, it will be designated by the NRC as "Service Sensitive." Leakage detection and augmented inservice inspection requirements for "Nonconforming" lines and "Nonconforming, Service Sensitive" lines are specified below:

*Since no IGSCC has been observed in the domestic plants and in view of the possible high radiation exposure to the inspection personnel, surveillance and monitoring means other than those specified in Section IV of this report for recirculation riser lines will be considered on a case-by-case basis.

IV.B.1. "Nonconforming" Lines That Are Not "Service Sensitive"

B. SUMMARY

CP&L has classified the 28-in. recirculation suction lines, 28-in. recirculation discharge lines, and 22-in. recirculation header as "nonservice sensitive".

CP&L does not meet NUREG-0313, Rev. 1 in this matter.

DIFFERENCES

NUREG-0313, Rev. 1 includes provisions for classifying nonconforming pipe as "service sensitive" or "nonservice sensitive". "Service sensitive" and "nonservice sensitive" pipe have different augmented ISI requirements.

CP&L has classified the following pipes as "nonservice sensitive" when they have been classified as "service sensitive" by NRC personnel:

1. 28-in. recirculation suction lines
2. 28-in. recirculation discharge lines
3. 22-in. recirculation header.[7]

ADDITIONAL DATA REQUIRED

None.

1. The comments on IV.B. also apply here.

IV.B.1.a. Leak Detection: The reactor coolant leakage detection systems should be operated under the Technical Specification requirements to enhance the discovery of unidentified leakage that may include through-wall cracks developed in austenitic stainless steel piping.

IV.B.1.a.(1) The leakage detection system provided should include sufficiently diverse leak detection methods with adequate sensitivity to detect and measure small leaks in a timely manner and to identify the leakage sources within the practical limits. Acceptable leakage detection and monitoring systems are described in Section C, Regulatory Position of Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems."

Particular attention should be given to upgrading and calibrating those leak detection systems that will provide prompt indication of an increase in leakage rate.

Other equivalent leakage detection and collection systems will be reviewed on a case-by-case basis.

a. The comments on IV.B. also apply here.

(1) SUMMARY

CP&L's description of the Brunswick 1 and 2 leak detection methods is not detailed enough to evaluate compliance with Section C of Regulatory Guide 1.45.

DIFFERENCES

The nine subsections of Section C of Regulatory Guide 1.45 are discussed below.

C.1 CP&L has stated that leakage to the primary reactor containment from identified sources is collected such that

a. the flow rates are monitored separately from unidentified leakage,[10] and

b. the total flow rate can be established and monitored.[10]

C.2 It is not clear from the Brunswick 1 and 2 Final Safety Analysis Report (FSAR) that unidentified leakage to the primary reactor containment can be collected and the flow rate monitored with an accuracy of 1 gpm or better (FSAR Section 4.10.3).

C.3 The primary containment leak detection systems consist of the following:

a. Primary Containment Sump Flow Integrating System

b. Primary Containment Atmospheric Particulate Radioactivity Monitoring System

c. Primary Containment Gaseous Radioactivity Monitoring System

d. Average Drywell Temperature

e. Drywell Pressure.[7]

The three methods recommended by Subsection C.3 of Regulatory Guide 1.45 are present.

C.4 It is not clear whether provisions have been made in the Brunswick 1 and 2 FSAR to monitor systems connected to the RCPB for signs of intersystem leakage.

C.5 The sensitivity of the primary containment sump flow integrating system is such that it can detect a 1-gpm leak in 1 to 8 h.[8]

C.6 The Brunswick 1 and 2 airborne particulate radioactivity monitoring system remains functional when subjected to the SSE.[8]

C.7 Indicators and alarms for the required leakage detection system are provided in the main control room. Procedures for converting various indications to a common leakage equivalent are available to the operators.[10]

It is not known whether calibration of the indicators accounts for the needed independent variables.

C.8 All Brunswick 1 and 2 leak detection systems enumerated in Reference 8 can be calibrated or tested during operation.

C.9 The Brunswick 1 and 2 FSAR include limiting conditions for identified and unidentified leakage.[8]

CP&L has identified the availability of the Brunswick 1 and 2 systems for detecting and monitoring leakage. Two of the three systems

a. the primary containment atmospheric particulate monitoring system,

b. tne primary containment sump flow integrating system, or

c. the primary containment gaseous radioactivity monitoring system

are always available.

It cannot be determined from the above whether Brunswick 1 and 2 meet all the requirements of Regulatory Guide 1.45, Section C.

ADDITIONAL DATA REQUIRED

1. Indicate whether provisions have been made in the Brunswick 1 and 2 FSAR to monitor systems connected to the RCPB for signs of intersystem leakage (Subsection C.4 of Regulatory Guide 1.45).

2. Indicate whether calibration of the indicators accounts for the needed independent variables (Subsection C.7 of Regulatory Guide 1.45).

3. Indicate whether unidentified leakage to the primary reactor containment can be collected and flow rate monitored with an accuracy of 1 gpm or better (Subsection C.2 of Regulatory Guide 1.45).

IV.B.1.a.(2) Plant shutdown should be initiated for inspection and corrective action when any leakage detection system indicates, within a period of 24 hours or less, an increase in rate of unidentified leakage in excess of 2 gallons per minute or its equivalent, or when the total unidentified leakage attains a rate of 5 gallons per minute or its equivalent, whichever occurs first. For sump level monitoring systems with fixed-measurement interval method, the level should be monitored at 4-hour intervals or less.

(2) SUMMARY

CP&L has included a provision for shutdown for a 2-gpm increase in unidentified leakage in 24 h in the Brunswick 1 and 2 Technical Specifications.

However, CP&L has not included provisions that fully meet NUREG-0313, Rev. 1.

DIFFERENCES

NUREG-0313, Rev. 1 requires that reactor shutdown be initiated when there is a 2-gpm increase in unidentified leakage in 24 h. For sump level monitoring systems with the fixed-measurement interval method, the level should be monitored every 4 h or less.

CP&L has included the provision that shutdown be initiated for a 2-gpm increase in unidentified leakage in 24 h into the proposed Brunswick 1 and 2 Technical Specifications. However, CP&L has not put the provision for monitoring the sump level at 4-h intervals or less into the Brunswick 1 and 2 Technical Specifications.[9]

ADDITIONAL DATA REQUIRED

Indicate the monitoring interval of the sump level monitoring systems with the fixed-measurement interval method.

IV.B.1.a.(3) Unidentified leakage should include all leakage other than:

(3) CP&L's definition of unidentified leakage for Brunswick 1 and 2 meets NUREG-0313, Rev. 1 (FSAR Section 4.10.3).

IV.B.1.a.(3)(a) Leakage into closed systems, such as pump seal or valve packing leaks that are captured, flow metered, and conducted to a sump or collecting tank, or

(a) The comments on IV.B.1.a.(3) also apply here.

IV.B.1.a.(3)(b) Leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operations of unidentified leakage monitoring systems or not to be from a through-wall crack in the piping within the reactor coolant pressure boundary.

(b) The comments on IV.B.1.a.(3) also apply here.

IV.B.1.b. Augmented Inservice Inspection: Inservice inspection of the "Nonconforming, Nonservice Sensitive" lines should be conducted in accordance with the following program:*

*This program is largely taken from the requirements of ASME Boiler & Pressure Vessel Code, Section XI, referenced in the paragraph (b) of 10 CFR 50.55a, "Codes and Standards."

b. SUMMARY

CP&L has committed to inspecting a lower percentage than NUREG-0313, Rev. 1 may require of the welds in the ASME Code Class 1 "nonservice sensitive" pipe in Brunswick 1. CP&L has not identified the welds in the ASME Code Class 1 "nonservice sensitive" pipe to be inspected in Brunswick 2.

CP&L has not provided sufficient data to evaluate whether Brunswick 1 and 2 meet NUREG-0313, Rev. 1.

DIFFERENCES

NUREG-0313, Rev. 1 requires that ASME Code Class 1 "nonservice sensitive" pipes be subject to an augmented ISI program. Selection methods for pipes to be examined are found in Part IV.B.1.b. of NUREG-0313, Rev. 1.

CP&L has indicated that 8 welds out of a total of 63 will be inspected on Brunswick 1. CP&L, however, has not indicated which 8 of the 63 welds in Brunswick 1's "nonservice sensitive" pipe will be inspected and the intervals of their inspections. Also, CP&L has not disclosed what they plan to do with the other 55 of the 63 welds--whether they will be inspected or the inspection intervals.

CP&L has not listed the welds in the "nonservice sensitive" pipe for Brunswick 2.[8]

ADDITIONAL DATA REQUIRED

1. Give technical justification for not inspecting the 63 "nonservice sensitive" welds in Brunswick 1 per NUREG-0313, Rev. 1.

2. Provide the inspection schedule for the 8 of the 63 welds to be inspected.

3. Indicate whether the other 55 of the 63 welds (i.e., the ones not to be inspected) in "nonservice sensitive" pipe will be subjected to augmented ISI per NUREG-0313, Rev. 1. If not, please provide technical justification for this course of action.

4.a. Please indicate whether there is any ASME Code Class 1 nonconforming "nonservice sensitive" pipe in Brunswick 2.

b. If the answer to the above question is yes, please provide your augmented ISI plans for the welds on these "nonservice sensitive" pipes.

IV.B.1.b.(1) For ASME Code Class 1 components and piping, each pressure-retaining dissimilar metal weld subject to inservice inspection requirements of Section XI should be examined at least once in no more than 80 months (two-thirds of the time prescribed in the ASME Boiler and Pressure Vessel Code Section XI). Such examination should include all internal attachment welds that are not through-wall welds but are welded to or form part of the pressure boundary.

(1) The comments on IV.B.1.b. also apply here.

IV.B.1.b.(2) The following ASME Code Class 1 pipe welds subject to inservice inspection requirements of Section XI should be examined at least once in no more than 80 months:

(2) The comments on IV.B.1.b. also apply here.

IV.B.1.b.(2)(a) All welds at terminal ends* of pipe at vessel nozzles;

(a) The comments on IV.B.1.b. also apply here.

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*Terminal ends are the extremities of piping runs that connect to structures, components (such as vessels, pumps, valves) or pipe anchors, each of which acts as rigid restraints or provides at least two degrees of restraint to piping thermal expansion.

IV.B.1.b.(2)(b) All welds having a design combined primary plus secondary stress range of $2.4S_m$ or more;

(b) The comments on IV.B.1.b. also apply here.

IV.B.1.b.(2)(c) All welds having a design cumulative fatigue usage factor of 0.4 or more; and

(c) The comments on IV.B.1.b. also apply here.

IV.B.1.b.(2)(d) Sufficient additional welds with high potential for cracking to make the total equal to 25% of the welds in each piping system.

(d) The comments on IV.B.1.b. also apply here.

IV.B.1.b.(3) The following ASME Code Class 2 pipe welds, subject to inservice inspection requirements of Section XI, in residual heat removal systems, emergency core cooling systems, and containment heat removal systems should be examined at least once in no more than 80 months:

(3) SUMMARY

CP&L has not identified those nonconforming "nonservice sensitive" pipes which are to be inspected per Part IV.B.1.b.(3) of NUREG-0313, Rev. 1. Data are needed to determine which "nonservice sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used.

IV.B.1.b.(3)(a)	All welds of the terminal ends of pipe at vessel nozzles, and	
IV.B.1.b.(3)(b)	At least 10% of the welds selected proportionately from the following categories:	
IV.B.1.b.(3)(b)(i)	Circumferential welds at locations where the stresses under the loadings resulting from any plant conditions as calculated by the sum of Equations (9) and (10) in NC-3652 exceed 0.8 ($1.2S_h + S_A$);	(i) The comments on IV.B.1.b.(3) also apply here.
IV.B.1.b.(3)(b)(ii)	Welds at terminal ends of piping, including branch runs;	(ii) The comments on IV.B.1.b.(3) also apply here.
IV.B.1.b.(3)(b)(iii)	Dissimilar metal welds;	(iii)The comments on IV.B.1.b.(3) also apply here.
IV.B.1.b.(3)(b)(iv)	Welds at structural discontinuities; and	(iv) The comments on IV.B.1.b.(3) also apply here.
IV.B.1.b.(3)(b)(v)	Welds that cannot be pressure tested in accordance with IWC-5000.	(v) The comments on IV.B.1.b.(3) also apply here.
	The welds to be examined shall be distributed approximately equally among runs (or portions of runs) that are essentially similar in design, size, system function, and service conditions.	

DIFFERENCES

NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping. Also, augmented ISI requirements differ for ASME Code Class 2 pipes to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1.

CP&L has submitted the augmented ISI program for nonconforming "nonservice sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping, and between the ASME Code Class 2 pipes which are to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated.

ADDITIONAL DATA REQUIRED

Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.1.b.(3) and which inspection procedures will be used.

IV.B.1.b.(4)	The following ASME Code Class 2 pipe welds in systems other than residual heat removal systems, emergency core cooling systems, and containment heat removal systems, which are subject to inservice inspection requirements of Section XI, should be inspected at least once in no more than 80 months:	(4) SUMMARY CP&L has not identified those nonconforming "nonservice sensitive" pipes which are to be inspected per Part IV.B.1.b.(4) of NUREG-0313, Rev. 1. Data are needed to determine which "nonservice sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used. DIFFERENCES NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping. Also, augmented ISI requirements differ for ASME Code Class 2 pipes to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1. CP&L has submitted the augmented ISI program for nonconforming "nonservice sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping, and between the ASME Code Class 2 pipes which are to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated. ADDITIONAL DATA REQUIRED Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.1.b.(4) and which inspection procedures will be used.
IV.B.1.b.(4)(a)	All welds at locations where the stresses under the loadings resulting from "Normal" and "Upset" plant conditions including the operating basis earthquake (OBE) as calculated by the sum of Equations (9) and (10) in NC-3652 exceed 0.8 $(1.2S_h + S_A)$;	(a) The comments on IV.B.1.b.(4) also apply here.
IV.B.1.b.(4)(b)	All welds at terminal ends of piping, including branch runs;	(b) The comments on IV.B.1.b.(4) also apply here.
IV.B.1.b.(4)(c)	All dissimilar metal welds;	(c) The comments on IV.B.1.b.(4) also apply here.
IV.B.1.b.(4)(d)	Additional welds with high potential for cracking at	(d) The comments on IV.B.1.b.(4) also apply here.

structural discontinuities* such that the total number of welds selected for examination equal to 25% of the circumferential welds in each piping system.

*Structural discontinuities include pipe weld joints to vessel nozzles, valve bodies, pump casings, pipe fittings (such as elbows, tees, reducers, flanges, etc., conforming to ANSI Standard B 16.9) and pipe branch connections and fittings.

IV.B.1.b.(5) If examination of (1), (2), (3), and (4) above conducted during the first 80 months reveal no incidence of stress corrosion cracking, the examination frequency thereafter can revert to 120 months as prescribed in Section XI of the ASME Boiler and Pressure Vessel Code.

(5) The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04.

IV.B.1.b.(6) Sampling plans other than those described in (2), (3), and (4) above will be reviewed on a case-by-case basis.

(6) No comment made because the part gives information only or is a heading.

IV.B.2. "Nonconforming" Lines That are "Service Sensitive"

IV.B.2.a. Leak Detection: The leakage detection requirements, described in IV.B.1.a. above, should be implemented.

a. The comments made in Parts IV.B.1.a.(1) and IV.B.1.a.(2) apply here.

IV.B.2.b. Augmented Inservice Inspection:

b. SUMMARY

CP&L has committed to inspecting less than 100% of the welds in the ASME Code Class 1 "service sensitive" pipe in Brunswick 1. CP&L has not identified the welds in the ASME Code Class 1 "service sensitive" pipe to be inspected in Brunswick 2.

CP&L has not provided sufficient information to determine whether Brunswick 1 and 2 meet NUREG-0313, Rev. 1.

DIFFERENCES

NUREG-0313, Rev. 1 requires that 100% of the welds in ASME Code Class 1 "service sensitive" pipes be subject to an augmented ISI program. Selection methods for pipes to be inspected are found in Part IV.B.2.b. of NUREG-0313, Rev. 1.

CP&L has indicated that 27 of 46 welds in Brunswick 1's "service sensitive" pipe will be inspected. However, CP&L has not indicated which 27 of the 46 welds in Brunswick 1's "service sensitive" pipe will be inspected and the intervals of the inspections. CP&L has not disclosed what they plan to do with the other 19 of the 46 welds--whether they will be inspected, or the inspection intervals.

CP&L has not listed the welds in the "service sensitive" pipe for Brunswick 2.[8]

ADDITIONAL DATA REQUIRED

1. Give technical justification for not inspecting all the welds in "service sensitive" pipes.

2. Provide the inspection schedule for the 27 of the 46 welds to be inspected.

3. Indicate whether the other 19 of the 46 welds (i.e., the ones not to be inspected) in "service sensitive" pipe will be subjected to augmented ISI per NUREG-0313, Rev. 1. If not, please provide technical justification for this course of action.

4.a. Please indicate if there is any ASME Code Class 1 nonconforming "service sensitive" pipe in Brunswick 2.

b. If the answer to the question above is yes, please provide your augmented ISI plans for the welds on these "service sensitive" pipes.

IV.B.2.b.(1) The welds and adjoining areas of bypass piping of the discharge valves in the main recirculation loops, and of the austenitic stainless steel reactor core spray piping up to and including the second isolation valve, should be examined at each reactor refueling outage or at other scheduled plant outages. Successive examination need not be closer than 6 months, if outages occur more frequently than 6 months. This requirement applies to all welds in all bypass lines whether the 4-inch valve is kept open or closed during operation.

(1) The comments on IV.B.2.b. also apply here.

	In the event these examinations find the piping free of unacceptable indications for three successive inspections, the examination may be extended to each 36-month period (plus or minus by as much as 12 months) coincident with a refueling outage. In these cases, the successive examination may be limited to all welds in one bypass pipe run and one reactor core spray piping run. If unacceptable flaw indications are detected, the remaining piping runs in each group should be examined. In the event these 36-month period examinations reveal no unacceptable indications for three successive inspections, the welds and adjoining areas of these piping runs should be examined as described in IV.B.1.b(1) for dissimilar metal welds and in IV.B.1.b(2) for other welds.	
IV.B.2.b.(2)	The dissimilar metal welds and adjoining areas of other ASME Code Class 1 "Service Sensitive" piping should be examined at each reactor refueling outage or at other scheduled plant outages. Successive examinations need not be closer than 6 months, if outages occur more frequently than 6 months. Such examination should include all internal attachments that are not through-wall welds but are welded to or form part of the pressure boundary.	(2) The comments on IV.B.2.b. also apply here.
IV.B.2.b.(3)	The welds and adjoining areas of other ASME Code Class 1 "Service Sensitive" piping should be examined using the sampling plan described in IV.B.1.b(2) except that the frequency of such examinations should be at each reactor refueling outage or at other scheduled plant outages. Successive examinations need not be closer than 6 months, if outages occur more frequently than 6 months.	(3) The comments on IV.B.2.b. also apply here.

IV.B.2.b.(4)	The adjoining areas of internal attachment welds in recirculation inlet lines at safe ends where crevices are formed by the welded thermal sleeve attachments should be examined at each reactor refueling outage or at other scheduled plant outages. Successive examinations need not be closer than 6 months, if outages occur more frequently than 6 months.	(4) The comments on IV.B.2.b. also apply here.
IV.B.2.b.(5)	In the event the examinations described in (2), (3) and (4) above find the piping free of unacceptable indications for three successive inspections, the examination may be extended to each 36-month period (plus or minus by as much as 12 months) coinciding with a refueling outage. In the event these 36-month period examinations reveal no unacceptable indications for three successive inspections, the frequency of examination may revert to 80-month periods (two-thirds the time prescribed in the ASME Code Section XI).	(5) The comments on IV.B.2.b. also apply here.
IV.B.2.b.(6)	The area, extent, and frequency of examination of the augmented inservice inspection for ASME Code Class 2 "Service Sensitive" lines will be determined on a case-by-case basis.	(6) SUMMARY CP&L has not identified those nonconforming "service sensitive" pipes which are to be inspected per Part IV.B.2.b.(6) of NUREG-0313, Rev. 1. Data are needed to determine which "service sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used. DIFFERENCES NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping. CP&L has submitted the augmented ISI program for nonconforming "service sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated.

IV.B.3. Nondestructive Examination (NDE) Requirements

The method of examination and volume of material to be examined, the allowable indication standards, and examination procedures should comply with the requirements set forth in the applicable Edition and Addenda of the ASME Code, Section XI, specified in Paragraph (g), "Inservice Inspection Requirements," of 10 CFR 50.55a, "Codes and Standards."

In some cases, the code examination procedures may not be effective for detecting or evaluating IGSCC and other ultrasonic (UT) procedures or advanced nondestructive examination techniques may be required to detect and evaluate stress corrosion cracking in austenitic stainless steel piping. Improved UT procedures have been developed by certain organizations. These improved UT detection and evaluation procedures that have been or can be demonstrated to the NRC to be effective in detecting IGSCC should be used in the inservice inspection. Recommendations for the development and eventual implementation of these improved techniques are included in Part V.

V. GENERAL RECOMMENDATIONS

The measures outlined in Part III of this document provide for positive actions that are consistent with current technology. The implementation of these actions should markedly reduce the susceptibility of stainless steel piping to stress corrosion cracking in BWRs. It is recognized that additional means could be used to limit the extent of stress corrosion cracking of BWR pressure boundary piping materials and to improve the overall system integrity. These include plant design and operational procedure considerations to reduce system exposure to potentially aggressive environment, improved material selection, special fabrication and welding techniques, and provisions for volumetric inspection capability in the design of weld joints. The use of such means to limit IGSCC or to improve plant system integrity will be reviewed on a case-by-case basis.

ADDITIONAL DATA REQUIRED

1. Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.2.b.(6).

2. Identify the inspection procedures for "service sensitive" ASME Code Class 2 pipe.

3. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04.

V. The licensee has not furnished data on this paragraph in his responses to NRC Generic Letter 81-04.

TABLE 2

SUMMARIES OF EVALUATION
OF LICENSEE'S RESPONSES

II.C Material Selection, Testing, and Processing Guidelines for BWRs with an Operating License

Carolina Power and Light (CP&L) will replace or repair affected lines if IGSCC is found during augmented ISI and has provided an alternative to NUREG-0313, Rev. 1.

IV.B. "Service Sensitive" Pipe

CP&L has classified the 28-in. recirculation suction lines, 28-in. recirculation discharge lines, and 22-in. recirculation header as "nonservice sensitive".

CP&L does not meet NUREG-0313, Rev. 1 in this matter.

IV.B.1.a.(1) Leak Detection and Monitoring Systems

CP&L's description of the Brunswick 1 and 2 leak detection methods is not detailed enough to evaluate compliance with Section C of Regulatory Guide 1.45.

IV.B.1.a.(2) Leak Detection Requirements

CP&L has included a provision for shutdown for a 2-gpm increase in unidentified leakage in 24 h in the Brunswick 1 and 2 Technical Specifications.

However, CP&L has not included provisions that fully meet NUREG-0313, Rev. 1.

IV.B.1.b. Augmented ISI of "Nonservice Sensitive" Pipe

CP&L has committed to inspecting a lower percentage than NUREG-0313, Rev. 1 may require of the welds in the ASME Code Class 1 "nonservice sensitive" pipe in Brunswick 1. CP&L has not identified the welds in the ASME Code Class 1 "nonservice sensitive" pipe to be inspected in Brunswick 2.

CP&L has not provided sufficient data to evaluate whether Brunswick 1 and 2 meet NUREG-0313, Rev. 1.

IV.B.1.b.(3) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

CP&L has not identified those nonconforming "nonservice sensitive" pipes which are to be inspected per Part IV.B.1.b.(3) of NUREG-0313, Rev. 1. Data are needed to determine which "nonservice sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used.

IV.B.1.b.(4) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

CP&L has not identified those nonconforming "nonservice sensitive" pipes which are to be inspected per Part IV.B.1.b.(4) of NUREG-0313, Rev. 1. Data are needed to determine which "nonservice sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used.

IV.B.2.b. Augmented ISI of "Service Sensitive" Pipe

CP&L has committed to inspecting less than 100% of the welds in the ASME Code Class 1 "service sensitive" pipe in Brunswick 1. CP&L has not identified the welds in the ASME Code Class 1 "service sensitive" pipe to be inspected in Brunswick 2.

CP&L has not provided sufficient information to determine whether Brunswick 1 and 2 meet NUREG-0313, Rev. 1.

IV.B.2.b.(6) Augmented ISI of Nonconforming "Service Sensitive" ASME Code Class 2 Pipe

CP&L has not identified those nonconforming "service sensitive" pipes which are to be inspected per Part IV.B.2.b.(6) of NUREG-0313, Rev. 1.

Data are needed to determine which "service sensitive" ASME Code Class 2 pipes will be inspected and what inspection procedures will be used.

TABLE 3

DIFFERENCES BETWEEN NUREG-0313, REV. 1
AND LICENSEE'S RESPONSES

II.C Material Selection, Testing, and Processing Guidelines for BWRs with an Operating License

NUREG-0313, Rev. 1 requires that nonconforming NRC-designated "service sensitive" lines be replaced with corrosion-resistant materials. Also, lines that experience cracking should be replaced with corrosion-resistant materials.

CP&L has indicated they will replace or repair affected lines if IGSCC is found during augmented ISI.[7]

IV.B. "Service Sensitive" Pipe

NUREG-0313, Rev. 1 includes provisions for classifying nonconforming pipe as "service sensitive" or "nonservice sensitive". "Service sensitive" and "nonservice sensitive" pipe have different augmented ISI requirements.

CP&L has classified the following pipes as "nonservice sensitive" when they have been classified as "service sensitive" by NRC personnel:

1. 28-in. recirculation suction lines

2. 28-in. recirculation discharge lines

3. 22-in. recirculation header.[7]

IV.B.1.a.(1) Leak Detection and Monitoring Systems

The nine subsections of Section C of Regulatory Guide 1.45 are discussed below.

C.1 CP&L has stated that leakage to the primary reactor containment from identified sources is collected such that

a. the flow rates are monitored separately from unidentified leakage,[10] and

b. the total flow rate can be established and monitored.[10]

C.2 It is not clear from the Brunswick 1 and 2 Final Safety Analysis Report (FSAR) that unidentified leakage to the primary reactor containment can be collected and the flow rate monitored with an accuracy of 1 gpm or better (FSAR Section 4.10.3).

C.3 The primary containment leak detection systems consist of the following:

a. Primary Containment Sump Flow Integrating System

b. Primary Containment Atmospheric Particulate Radioactivity Monitoring System

c. Primary Containment Gaseous Radioactivity Monitoring System

d. Average Drywell Temperature

e. Drywell Pressure.[7]

The three methods recommended by Subsection C.3 of Regulatory Guide 1.45 are present.

C.4 It is not clear whether provisions have been made in the Brunswick 1 and 2 FSAR to monitor systems connected to the RCPB for signs of intersystem leakage.

C.5 The sensitivity of the primary containment sump flow integrating system is such that it can detect a 1-gpm leak in 1 to 8 h.[8]

C.6 The Brunswick 1 and 2 airborne particulate radioactivity monitoring system remains functional when subjected to the SSE.[8]

C.7 Indicators and alarms for the required leakage detection system are provided in the main control room. Procedures for converting various indications to a common leakage equivalent are available to the operators.[10]

It is not known whether calibration of the indicators accounts for the needed independent variables.

C.8 All Brunswick 1 and 2 leak detection systems enumerated in Reference 8 can be calibrated or tested during operation.

C.9 The Brunswick 1 and 2 FSAR include limiting conditions for identified and unidentified leakage.[8]

CP&L has identified the availability of the Brunswick 1 and 2 systems for detecting and monitoring leakage. Two of the three systems

a. the primary containment atmospheric particulate monitoring system,

b. the primary containment sump flow integrating system, or

c. the primary containment gaseous radioactivity monitoring system

are always available.

It cannot be determined from the above whether Brunswick 1 and 2 meet all the requirements of Regulatory Guide 1.45, Section C.

IV.B.1.a.(2) Leak Detection Requirements

NUREG-0313, Rev. 1 requires that reactor shutdown be initiated when there is a 2-gpm increase in unidentified leakage in 24 h. For sump level monitoring systems with the fixed-measurement interval method, the level should be monitored every 4 h or less.

CP&L has included the provision that shutdown be initiated for a 2-gpm increase in unidentified leakage in 24 h into the proposed Brunswick 1 and 2 Technical Specifications. However, CP&L has not put the provision for monitoring the sump level at 4-h intervals or less into the Brunswick 1 and 2 Technical Specifications.[9]

IV.B.1.b. Augmented ISI of "Nonservice Sensitive" Pipe

NUREG-0313, Rev. 1 requires that ASME Code Class 1 "nonservice sensitive" pipes be subject to an augmented ISI program. Selection methods for pipes to be examined are found in Part IV.B.1.b. of NUREG-0313, Rev. 1.

CP&L has indicated that 8 welds out of a total of 63 will be inspected on Brunswick 1. CP&L, however, has not indicated which 8 of the 63 welds in Brunswick 1's "nonservice sensitive" pipe will be inspected and the intervals of their inspections. Also, CP&L has not disclosed what they plan to do with the other 55 of the 63 welds--whether they will be inspected or the inspection intervals.

CP&L has not listed the welds in the "nonservice sensitive" pipe for Brunswick 2.[8]

IV.B.1.b.(3) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping. Also, augmented ISI requirements differ for ASME Code Class 2 pipes to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1.

CP&L has submitted the augmented ISI program for nonconforming "nonservice sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping, and between the ASME Code Class 2 pipes which are to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated.

IV.B.1.b.(4) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping. Also, augmented ISI requirements differ for ASME Code Class 2 pipes to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1.

CP&L has submitted the augmented ISI program for nonconforming "nonservice sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping, and between the ASME Code Class 2 pipes which are to be inspected per Parts IV.B.1.b.(3) and IV.B.1.b.(4) of NUREG-0313, Rev. 1. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated.

IV.B.2.b. Augmented ISI of "Service Sensitive" Pipe

NUREG-0313, Rev. 1 requires that 100% of the welds in ASME Code Class 1 "service sensitive" pipes be subject to an augmented ISI program. Selection methods for pipes to be inspected are found in Part IV.B.2.b. of NUREG-0313, Rev. 1.

CP&L has indicated that 27 of 46 welds in Brunswick 1's "service sensitive" pipe will be inspected. However, CP&L has not indicated which 27 of the 46 welds in Brunswick 1's "service sensitive" pipe will be inspected and the intervals of the inspections. CP&L has not disclosed what they plan to do with the other 19 of the 46 welds--whether they will be inspected, or the inspection intervals.

CP&L has not listed the welds in the "service sensitive" pipe for Brunswick 2.[8]

IV.B.2.b.(6) Augmented ISI of Nonconforming "Service Sensitive" ASME Code Class 2 Pipe

NUREG-0313, Rev. 1 requires that nonconforming ASME Code Class 1 and Class 2 piping be subjected to an augmented ISI program. The augmented ISI program for ASME Code Class 1 piping differs from that required on Class 2 piping.

CP&L has submitted the augmented ISI program for nonconforming "service sensitive" piping, but has not distinguished between the ASME Code Class 1 and Class 2 piping. Therefore, CP&L's program for ASME Code Class 2 piping cannot be evaluated.

TABLE 4

ADDITIONAL DATA REQUIRED
OF LICENSEE

II.C Material Selection, Testing, and Processing Guidelines for BWRs with an Operating License

None.

IV.B. "Service Sensitive" Pipe

None.

IV.B.1.a.(1) Leak Detection and Monitoring Systems

1. Indicate whether provisions have been made in the Brunswick 1 and 2 FSAR to monitor systems connected to the RCPB for signs of intersystem leakage (Subsection C.4 of Regulatory Guide 1.45).

2. Indicate whether calibration of the indicators accounts for the needed independent variables (Subsection C.7 of Regulatory Guide 1.45).

3. Indicate whether unidentified leakage to the primary reactor containment can be collected and flow rate monitored with an accuracy of 1 gpm or better (Subsection C.2 of Regulatory Guide 1.45).

IV.B.1.a.(2) Leak Detection Requirements

Indicate the monitoring interval of the sump level monitoring systems with the fixed-measurement interval method.

IV.B.1.b. Augmented ISI of "Nonservice Sensitive" Pipe

1. Give technical justification for not inspecting the 63 "nonservice sensitive" welds in Brunswick 1 per NUREG-0313, Rev. 1.

2. Provide the inspection schedule for the 8 of the 63 welds to be inspected.

3. Indicate whether the other 55 of the 63 welds (i.e., the ones not to be inspected) in "nonservice sensitive" pipe will be subjected to augmented ISI per NUREG-0313, Rev. 1. If not, please provide technical justification for this course of action.

4.a. Please indicate whether there is any ASME Code Class 1 nonconforming "nonservice sensitive" pipe in Brunswick 2.

b. If the answer to the above question is yes, please provide your augmented ISI plans for the welds on these "nonservice sensitive" pipes.

IV.B.1.b.(3) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.1.b.(3) and which inspection procedures will be used.

IV.B.1.b.(4) Augmented ISI of Nonconforming "Nonservice Sensitive" ASME Code Class 2 Pipe

Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.1.b.(4) and which inspection procedures will be used.

IV.B.2.b. Augmented ISI of "Service Sensitive" Pipe

1. Give technical justification for not inspecting all the welds in "service sensitive" pipes.

2. Provide the inspection schedule for the 27 of the 46 welds to be inspected.

3. Indicate whether the other 19 of the 46 welds (i.e., the ones not to be inspected) in "service sensitive" pipe will be subjected to augmented ISI per NUREG-0313, Rev. 1. If not, please provide technical justification for this course of action.

4.a. Please indicate if there is any ASME Code Class 1 nonconforming "service sensitive" pipe in Brunswick 2.

b. If the answer to the question above is yes, please provide your augmented ISI plans for the welds on these "service sensitive" pipes.

IV.B.2.b.(6) Augmented ISI of Nonconforming "Service Sensitive" ASME Code Class 2 Pipe

1. Identify which ASME Code Class 2 pipe will be inspected per Part IV.B.2.b.(6).

2. Identify the inspection procedures for "service sensitive" ASME Code Class 2 pipe.

4. REFERENCES

1. E. D. Eason et al., The Cost Effectiveness of Countermeasures to Intergranular Stress Corrosion Cracking in BWR Piping, EPRI NP-1703, February 1981, p. A-04.

2. U.S. Nuclear Regulatory Commission, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping, USNRC Report NUREG-0313, July 1977.

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4. U.S. Nuclear Regulatory Commission, Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants, USNRC Report NUREG-0531, February 1979.

5. U.S. Nuclear Regulatory Commission, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping, USNRC Report NUREG-0313, Rev. 1, July 1980.

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7. E. E. Utley to T. A. Ippolito letter, July 7, 1981 (NRC Accession No.: 8107130359).

8. E. E. Utley to D. B. Vassallo letter, February 8, 1983 (NRC Accession No.: 8302150602).

9. Brunswick 1 Technical Specifications.

10. Brunswick 1 and 2 Final Safety Analysis Report, Section 4.10.

NRC FORM 335 (11 81)

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