October 26, 2006

MEMORANDUM TO: J. E. Dyer, Director
Office of Nuclear Reactor Regulation

FROM: John A. Grobe, Associate Director **/RA/**
for Engineering and Safety Systems
Office of Nuclear Reactor Regulation

SUBJECT: DIFFERING PROFESSIONAL OPINION (DPO) PANEL RESPONSE TO DPO-2006-003

By memorandum dated June 2, 2006, you established a Differing Professional Opinion (DPO) Ad Hoc Review Panel to review the DPO pertaining to the use of leak-before-break (LBB) technology in the design of a facility modification involving the emergency core cooling system (ECCS) at Oconee, Units 1, 2 and 3 and report its recommendations to you. The panel has completed its review of the matters raised by the Submitter regarding the application of LBB technology in the low pressure injection (LPI) system cross-connect modification at Oconee, Units 1, 2 and 3. The results of the panel's evaluation of the concerns raised in the DPO are detailed in the enclosed DPO panel report.

Based on its review of concerns raised in the DPO, the panel has made the following conclusions:

- The Submitter's concern regarding inappropriate application of LBB technology in the LPI cross-connect modification at Oconee, Units 1, 2 and 3 was based on an incorrect understanding of the Commission's regulations and policy on the use of LBB technology in the design of the ECCS. The regulations and policy support the staff's decision to authorize the application of LBB technology to this modification.

- The NRC staff reviewed and documented the approval of the LPI cross-connect modification for Oconee, Units 1, 2 and 3 pursuant to the draft Standard Review Plan 3.6.3, "Leak-Before-Break Evaluation".

- Had NRR and Regional Division management effectively engaged in resolution of this issue, or had the Task Interface Process been used, the need for a DPO may have been avoided.

During the course of the review of this DPO, one additional issue was raised and resolved as described in the Enclosure. The panel has the following recommendation for consideration:

- The staff should develop a knowledge management document describing the NRC's policy and practice on the application of LBB.

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The Office of General Counsel (OGC) has reviewed the DPO Panel Report with respect to the discussion of the regulatory history and General Design Criterion 4, and the applicability to the Oconee plant. OGC comments on the Report have been appropriately addressed.

Please do not hesitate to contact me if you have any questions regarding the enclosed report.

Enclosure:
As Stated

The Office of General Counsel (OGC) has reviewed the DPO Panel Report with respect to the discussion of the regulatory history and General Design Criterion 4, and the applicability to the Oconee plant. OGC comments on the Report have been appropriately addressed.

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Enclosure:
As Stated

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ENCLOSURE

Differing Professional Opinion (DPO)
On
Application of Leak-Before-Break Technology at Oconee
DPO-2006-003

DPO Panel Report

/RA/
John A. Grobe, Panel Chair

/RA/
Mark A. Caruso, Panel Member

/RA/
Aladar A. Csontos, Panel Member

/RA/
Joseph J. Lenahan, Panel Member

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Executive Summary

Differing Professional Opinion (DP0) 2006-003 disagrees with the Nuclear Regulatory Commission (NRC) staff's decision to authorize the application of leak-before-break (LBB) technology in the design of a facility modification involving the emergency core cooling system (ECCS). The DPO contends that such authorization expands the use of LBB technology beyond that which has been approved by the Commission by allowing it to be used to exclude dynamic effects from the design basis of sections of piping and components in the ECCS. A DPO panel was formed to review the issues. The DPO panel found that the contention was based on a misunderstanding of the Commission's regulations and policy on the use of LBB technology in the design of the ECCS. The panel concluded that both the regulations and policy support the staff's decision to authorize the application of LBB to this modification.

During the review, the panel identified two additional issues associated with the DPO. The first issue is the contention that the licensee has been applying LBB technology at the Oconee facility without proper NRC approval. The panel found that the staff sent a safety evaluation (SE) to the licensee in 1986 which provides the technical basis for approving applications of LBB technology to RCS primary loop piping. The SE has been referenced repeatedly by the staff in subsequent licensing reviews. The panel has concluded, based on its review of the documents and interviews with NRC technical staff, that all applications of LBB at Oconee which were submitted to the NRC have been approved by the NRC.

The second issue involves the question of why the central issue raised in the DPO could not have been resolved through effective interaction between division management in the Regional Office and the Office of Nuclear Reactor Regulation (NRR) or through the established process for resolving questions on the application of regulations, i.e., the NRR Task Interface Agreement (TIA) process. The panel concluded that a DPO filing may have been avoided through effective interaction between Regional and NRR management.

1.0 Introduction

Differing Professional Opinion (DP0) 2006-003 disagrees with the Nuclear Regulatory Commission (NRC) staff's decision to authorize the application of leak-before-break (LBB) technology in a facility modification involving the emergency core cooling system (ECCS). The DPO states that such authorization expands the use of LBB technology beyond that which has been approved by the Commission. DPO-2006-003 was submitted for consideration on May 3, 2006. A DPO panel ("the panel") was formed on June 2, 2006 by James E. Dyer, Director, Office of Nuclear Reactor Regulation (NRR). The panel's charter is contained in a memorandum from James E. Dyer to the panel members dated June 2, 2006. On July 20, 2006, the panel met with the author of the DPO ("the Submitter") and presented their understanding of the concerns stated in the DPO. At this meeting, the author acknowledged his agreement with the panel's understanding of the concerns.

The panel has reviewed the issues raised in DPO-2006-003. The panel's findings and conclusions are the subject of this report. During the review, the panel identified two additional issues associated with the DPO. The first issue is the contention that the licensee has been applying LBB technology at the Oconee facility without NRC approval. The second issue involves the question of why the central issue raised in the DPO could not have been resolved through effective interaction between division management in the Regional Office and NRR or the established NRR process for resolving questions on the application of regulations. The panel's findings and conclusions regarding each of these two issues are also discussed in the report.

2.0 Background

On March 20, 2003, Duke Power Company (DPC) ("the licensee") submitted an application to the NRC to modify the Oconee Units 1, 2 and 3 facility by adding a normally open cross-connect line between the redundant discharge lines of the low pressure injection (LPI) system inside the containment building. Adding the cross-connect line eliminates the need for operators to exit the control room and manually cross-connect the trains outside containment under certain accident conditions. In their technical justification for the modification, the licensee credits LBB technology as the basis for excluding pipe whip and other dynamic effects from the design basis for the modification. Pipe whip damage to the cross-connect line from a double ended rupture of a core flood line at some locations could result in failure of both trains of the LPI system. The staff approved the design change and associated changes to technical specifications for the Oconee Units 1, 2 and 3 in letters to the licensee dated September 29, 2003, February 5, 2004 and September 2, 2004, respectively. The licensee has now installed the cross-connect line in all three Oconee units.

3.0 Statement of Concerns

The fundamental contention in DPO-2006-003 is that the cross-connect modification described above should not have been approved by the NRC nor implemented by the licensee because the LPI system, as modified, does not meet requirements in 10 CFR Part 50. These requirements include the requirement in Section 50.46 to provide long term cooling and requirements in Appendix A, General Design Criteria (GDC) 34 and 35 to provide suitable redundancy and isolation capability in the design of the ECCS and decay heat removal (DHR)

system. This contention stems from the interpretation of Commission policy that LBB cannot be used if the dynamic effects of the pipe rupture adversely affect the ECCS. In support of this position, the DPO cites passages from the certain Statements of Consideration for the final rule that modified Criterion 4 of the GDC (GDC-4) to permit exclusion of dynamic effects of high energy pipe ruptures from the design basis of systems, structures and components (SSC) based on LBB technology (52 FR 41294, October 27, 1987).

Further, DPO-2006-003 indicates that the NRC staff and licensees should receive additional guidance for the application of LBB technology. This opinion stems from the perception that the Commission had stated its intention that LBB technology not be used to exclude dynamic effects from the design basis for ECCS or the containment, yet staff had approved such use for the LPI cross-connect modification at Oconee.

4.0 Findings and Conclusions

4.1 Issue #1: Application of LBB in the LPI Cross-connect Modification

4.1.1 Findings

The panel began its review of the concerns in DPO-2006-003 by first studying the design of the Oconee LPI system as modified with the cross-connect. The panel reviewed the system description and drawings for the modified system, the licensee's amendment request and the staff's safety evaluation report for the LPI modification. The panel determined that when dynamic effects of core flood line ruptures are excluded from the design basis, as proposed by the licensee, there appeared to be no basis to challenge the conclusion that the LPI system, which also serves as the shutdown decay heat removal system, is in compliance with the requirements of 10 CFR 50.46, GDC 34 and GDC 35. This is because, with pipe whip damage eliminated, there appear to be no other credible single failures that could render both trains of the system inoperable. In light of this finding, the panel focused the remainder of its review on the question of whether or not the regulatory requirements and associated implementation guidance--pertinent to the use of LBB technology--were applied correctly in the review and approval of the LPI cross-connect modification.

The panel reviewed a number of documents and interviewed several cognizant members of the NRC technical staff in its examination of the use of LBB technology to support the LPI cross-connect modification. Documents particularly germane to the question at hand included:

- GDC-4 in 10 CFR Part 50, Appendix A, which governs the treatment of dynamic effects of pipe ruptures on systems, structures and components;
- Draft Standard Review Plan (SRP) Section 3.6.3, "Leak-Before-Break Evaluation Procedures", in NUREG-0800;
- Statements of Consideration for final rules that revised GDC-4 for exclusion of dynamic effects of reactor coolant system (RCS) primary loop pipe ruptures from the design basis of SSCs based on LBB technology (51 FR 12502, April 11, 1986), and the follow-on revision that extended the exclusion to all qualified high energy piping (52 FR 41288, October 27, 1987);

- Proposed rulemaking to modify GDC-4 published in the Federal Register (51 FR 26399, July 23, 1986);

- Solicitation of public comments by the NRC on additional applications of LBB technology published in the Federal Register (53 FR 11312, April 6, 1988);

- Commission policy statement on additional applications of LBB technology (54 FR 18649, May 2, 1989);

- NRC Staff technical paper on leak-before-break applications published in the International Journal of Pressure Vessels and Piping (vol. 43, pp 57-65, 1990).

The panel observed that neither GDC-4 nor SRP Section 3.6.3 make any distinction among SSCs as to which ones could or could not have dynamic effects excluded from their design basis. The panel found that the sole determining factor for exclusion is whether or not the piping whose rupture would produce the dynamic effects has an acceptably low likelihood of rupturing prior to producing a detectable indication of impending failure, i.e., leakage. SRP Section 3.6.3 provides the specific procedures and acceptance criteria for making this determination.

Prior to April of 1986, GDC-4 required that all SSCs important to safety be protected against the dynamic effects of pipe rupture accidents. It did not permit exclusion of these effects from the design basis under any circumstances. On April 11, 1986, GDC-4 was revised to allow the use of LBB technology for excluding from the design basis the dynamic effects of postulated ruptures in primary coolant loop piping in pressurized water reactors (PWRs). GDC-4 was revised again on October 27, 1987 to its current form. This revision expanded the scope for pipe rupture locations that could be treated with LBB technology. As revised, and currently, GDC-4 allows the use of LBB technology for excluding dynamic effects of postulated ruptures in high energy piping in any currently licensed commercial nuclear power plant, not just primary coolant loop piping in PWRs. High energy piping is defined as those systems having pressures exceeding 275 psig or temperatures exceeding 200 deg F. Currently, GDC-4 GDC states that:

> "Structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. However, dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping."

The last sentence in GDC-4 establishes conditions which must be met in order to exclude dynamic effects from the design basis. It was added in the April 11, 1986 revision and modified in the October 27, 1987 revision to broaden the scope for pipe rupture locations that could be treated with LBB technology.

The Commission summarized the basis for the October 27, 1987 revision to GDC-4 in Section II of the Federal Register notice:

> "This proposed amendment to GDC-4 allows exclusion from the design basis of dynamic effects associated with high energy pipe rupture by application of leak-before-break technology. Only high energy piping in nuclear power units that meet rigorous acceptance criteria is covered. High energy piping is defined as those systems having pressures exceeding 275 psig or temperatures exceeding 200 deg F."
>
> "Studies completed by Lawrence Livermore National Laboratory under contract to the NRC indicate that adverse safety implications can result from requiring protective devices to resist the dynamic effects associated with postulated pipe rupture. (See NUREG/CR-4263, Reliability Analysis of Stiff Versus Flexible Piping, Final Project Report, May 1985). The placement of pipe whip restraints degrades plant safety when thermal growth is inadvertently restricted, reduces the accessibility for and effectiveness of inservice inspections, increases inservice inspection radiation dosages and adversely affects construction and maintenance economics."

In Section III of the October 27, 1987 notice in the Federal Register , the Commission acknowledged that the rulemaking created an inconsistency in the design basis for emergency core cooling systems and containment:

> "This rulemaking will introduce an inconsistency into the design basis by excluding the dynamic effects of postulated pipe ruptures while still retaining nonmechanistic pipe rupture for emergency core cooling systems, containments and environmental qualification (see issue 4 below for additional information on potential relaxation with respect to environmental qualification). The Commission recognizes the need to address whether and to what extent leak-before-break analysis techniques may be used to modify present requirements relating to other features of facility design. However, this is a longer term evaluation. For the present the rule allows the removal of plant hardware which it is believed negatively affects plant performance and safety, while not affecting emergency core cooling systems, containments and environmental qualification." [The last sentence means: Functional performance of ECCS and containments, and environmental qualification of SSCs important to safety must continue to be based on a ruptures of a pipes in the reactor coolant system up to and including a double ended rupture of the largest pipe.]

The panel found that the Statement of Considerations for each of the modifications to GDC-4 contained a number of other statements that suggest that the modifications are not to be applied to ECCS or containment systems, such as this comment in Section III of the October 27, 1987 notice in the Federal Register:

> "To retain high safety margins, the application of leak before break technology to various piping systems should not decrease the capability of containments to perform their function of isolating the outside environment from potential leaks, breaks, or malfunctions within the containment. Containment will continue to be designed to accommodate loss of coolant accidents resulting from breaks in the reactor coolant pressure boundary up to and including a break equivalent in size to the double-ended

rupture of the largest pipe in the reactor coolant system. Also, the functional design for emergency core cooling systems still retains nonmechanistic pipe rupture."

The following quote is a public comment on the October 27, 1987 rule change published in Section VI of the October 27, 1987 notice in the Federal Register:

> "Leak-before-break technology should be extended to relax pipe rupture requirements for containment design, emergency core cooling systems and environmental qualification...."

The Commission's response is:

> "The Commission does not intend to consider near-term changes to emergency core cooling system and containment design basis as discussed in the Final Rule section...."

The panel discussed this apparent inconsistency between GDC-4, as modified, and the Statements of Consideration with staff who are experienced in the application of LBB. Their understanding of the Commission's position on the application of LBB in the design of ECCS and containment is that while potential damage from dynamic effects may be excluded from the design of ECCS per GDC-4, other important nonmechanistic (a.k.a. "global") effects of pipe ruptures, (e.g., reduction in reactor coolant inventory and pressurization of containment), cannot be excluded from the functional design requirements of ECCS and containment under any circumstances. Effects such as the loss of inventory from the RCS and the release of mass and energy globally to the containment, and all other effects explicitly accounted for in approved ECCS and containment performance analysis methods and models[1] need to be based on the most limiting pipe rupture event. The functional design requirements of ECCS and containments cannot be reduced or excluded from the design basis by applying LBB technology. This interpretation is supported by a comprehensive reading of the Statements of Consideration associated with the revisions to GDC-4, the solicitation of public comment by the NRC on additional applications of LBB technology and the NRC staff's technical paper published in the International Journal of Pressure Vessels and Piping. These documents explain the difference between potential local damaging dynamic effects that are uniquely associated with a pipe rupture and the effects of hypothesized nonmechanistic pipe ruptures used to define functional performance for the ECCS. The "non-dynamic" effects produced by a large pipe rupture simply serve as a convenient and conservative functional design umbrella for the ECCS.

The panel found that the April 6, 1988 notice in the Federal Register (53 FR 11312) soliciting comments on additional applications of leak-before-break technology is much more specific about what can and cannot be excluded from the design basis.

> "The specific functional and performance requirements retained when leak-before-break is accepted under the recent modification to GDC-4 are as follows:

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[1] For example, see 10 CFR 50, Appendix K; SRP Sections 6.2.1.1A, 6.2.1.1B, 6.2.1.1C, 6.2.1.3, 6.2.1.4, and 6.2.1.5.

1. *For Containments.* Global loads and environments associated with postulated pipe ruptures, including pressurization, internal flooding, and elevated temperature.

2. *For ECCS.* Heat removal and mass replacement capacity needed because of postulated pipe ruptures.

3. *For EQ.* Pressure, temperature, flooding level, humidity, chemical environment, and radiation resulting from postulated pipe ruptures.

However, under the recent [October 27, 1987] modification of GDC-4 local dynamic effects uniquely associated with pipe rupture may be deleted from the design basis of containment systems, structures and boundaries, from the design basis of ECCS hardware (such as pumps, valves, accumulators, and instrumentation). And from the design basis of safety related electrical and mechanical equipment when leak-before-break is accepted."

"...Thus, while functional and performance requirements for containments, ECCS and EQ remain unchanged under the now effective modification [October 27, 1987] of GDC-4, the design bases for these aspects of facility design have been modified in that local dynamic effects uniquely associated with ruptures in piping which qualified for leak-before-break may be excluded from consideration."

4.1.2 Conclusions

Based on its review, the panel concludes that GDC-4 does not prevent the use of LBB, even if the dynamic effects of a pipe rupture would adversely affect the ECCS. Rather, GDC-4 requires SSCs important to safety be appropriately protected against dynamic effects uniquely associated with a pipe rupture unless those effects can be excluded from the design basis of SSCs based on an approved analysis of the pipe. In addition, other parts of 10 CFR Part 50 require that nonmechanistic effects associated with pipe ruptures, such as, loss of cooling capacity in the RCS, be included in the design basis, with no exception.

The panel acknowledges that the Commission's intent on the use of LBB technology in the design of ECCS and containment is not clearly articulated in individual Statements of Consideration associated with changes to GDC-4; and, unless reviewed in their entirety, these documents can be misleading. However, clear explanations of the Commission's regulations have been documented which fully support the conclusion that neither the Commission's regulations nor Commission policy preclude the application of LBB technology in the Oconee LPI cross-connect modification, as approved by the staff.

The panel has found that the staff was not misguided in its application of GDC-4 in the LPI cross-connect review. Consequently, a revision to formal guidance for staff and licensees on the application of GDC-4, as suggested in the DPO, is not warranted. However, the panel believes that additional information could be developed and made available to the staff through the NRC knowledge management process that clarifies the relationship between GDC-4 and regulations that govern the design and operation of ECCS and containment. This could help prevent potential misunderstandings in the future on the part of NRC staff.

4.2 Issue #2: LBB Approval Process for Oconee

4.2.1 Findings

During interviews at the DPO panel meeting of July 20, 2006, the assertion was made by the Submitter that the licensee had credited LBB for Oconee RCS primary loop piping without proper approval by the NRC. In light of this assertion, and because NRC approval of the application of LBB technology is key to the evaluation of this DPO, the panel interviewed cognizant NRC staff and performed a review of historical documents to construct a sequence of regulatory activities regarding the approval and use of LBB technology at Oconee. Key events in the sequence are shown in Table 1.

The panel determined that a safety evaluation completed in 1985 was forwarded to the licensee in 1986 indicating that a satisfactory technical basis had been provided for crediting LBB technology to exclude consideration of dynamic effects of RCS primary loop pipe ruptures. The 1985 SE addresses BAW-1847 Rev. 1, submitted by the Babcock and Wilcox (B&W) Owners Group on behalf of several licensees, including the licensee for Oconee. The SE includes a generic bounding analysis that supports the use of LBB technology. The SE states that the analysis provides an acceptable basis for application of LBB technology to qualified piping at the facilities covered by the topical report. However, statements in the letter transmitting the SE to Oconee suggest that Oconee should submit additional supporting information with respect to the adequacy of leakage detection systems. Further, the SE concludes that the leakage detection systems at Oconee and the other facilities were acceptable for purposes of crediting LBB technology (i.e., they were designed and implemented "consistent with the guidelines of Regulatory Guide 1.45"). The panel reviewed an internal document prepared by the licensee following receipt of the SE which indicates that the licensee believed the review was complete and no additional action to support NRC review and approval was required in order to apply LBB to primary loop piping.

The panel also reviewed the staff's evaluations of topical reports providing generic bounding analyses supporting use of LBB in plants designed by Westinghouse and Combustion Engineering. The panel found that the SE for the Westinghouse topical report was issued to each licensee for a plant designed by Westinghouse, similar to the approach taken for licensees with plants designed by B&W. The transmittal letter and the SE for the Westinghouse facilities included statements clearly indicating that the adequacy of plant-specific leak detection systems had not been covered by the staff's evaluation and would need to be addressed by individual licensees in order for the staff to approve the use of LBB technology. For plants designed by Combustion Engineering, the staff forwarded the SE only to the Combustion Engineering Owners Group organization with guidance that it could be referenced in plant-specific licensing submittals. The SE included statements clearly indicating that the adequacy of plant-specific leak detection systems had not been covered by the staff's evaluation and would need to be addressed in plant-specific submittals in order for the staff to approve the use of LBB technology.

As listed in Table 1, Oconee received additional documents from the NRC indicating that the use of LBB technology for primary loop piping had been approved in the 1985 safety evaluation. This includes the staff's approval of the report BAW-2292, "Framatome Mark-B Spacer Grid Deformation in B&W Designed 177 Fuel Assembly Plants", in August 1997, the staff's approval

of the Oconee license renewal application in May 2000 and the staff's approval of the Oconee steam generator replacement in September 2001. In late 1997, the licensee modified the Oconee Updated Safety Analysis report in accordance with 10 CFR 50.59 to reflect the LBB methodology in the NRC approved topical report, BAW-2292P-A, Rev. 0.

In its review of the LPI cross-connect modification, the panel identified that an Oconee plant-specific review of the leakage detection systems was also performed by the staff in March 2003 as part of its review of the LBB analyses provided in support of the LPI cross-connect modification. The staff confirmed that the leakage detection system satisfied the requirements of Regulatory Guide 1.45, and therefore, adequately supports the application of LBB technology.

Table 1

Date	Event
Dec. 1985	Staff approves B&W Topical Report (BAW-1847, Rev. 1) which justifies use of LBB in RCS primary loop piping for several B&W plants.
Feb. 1986	Staff transmits SE on BAW-1847, Rev. 1 to DPC indicating that the report provides an adequate basis for eliminating dynamic effects of large ruptures in RCS primary loop piping as a design basis at Oconee. Staff requests information demonstrating that leakage detection systems installed at Oconee comply with Regulatory Guide 1.45.
April 1986	NRC revises GDC-4 such that staff approved LBB technology may be used as a basis for eliminating dynamic effects of large ruptures in RCS primary loop piping from the design basis for SSCs.
Oct. 1987	NRC revises GDC-4 such that staff approved LBB technology may be used as a basis for eliminating dynamic effects of large ruptures in all qualified high energy piping from the design basis for SSCs.
March 1997	B&WOG submits topical report BAW-2292 which justifies use of LBB technology in establishing impact loads for Framatome Mark-B fuel assembly spacer grids installed at Oconee and other B&W plants.
Aug. 1997	Staff approves BAW-2292. SE references the staff's Dec. 1985 approval of BAW-1847, Rev. 1 as the basis for accepting the use of LBB technology.
July 1998	Oconee USAR updated to reflect that (1) LBB technology was approved for use at Oconee per the Dec. 1985 SE and (2) the Framatome Mark-B fuel design is consistent with assumptions in the approved LOCA analysis of record.
May 2000	Staff approves License renewal application which relies in part on the application LBB technology. In the process, staff reviews July 1998 update to UFSAR pertaining to LBB and raises no objection.
Sept. 2001	Staff approves application of LBB to steam generator replacement. SE states that NRC accepted LBB with approval of BAW-1847, Rev. 1 in 1985.
March 2003	DPC submits application for LPI cross-connect modification including complete analysis of LBB applied to core flood line (high energy pipe) per GDC-4 and SRP 3.6.3.

Date	Event
Sept. 2003	Staff approves LPI cross-connect modification for unit 1, including LBB analysis for core flood line.
Feb. 2004	Staff approves LPI cross-connect modification for unit 2, including LBB analysis for core flood line.
Sept 2004	Staff approves LPI cross-connect modification for unit 3, including LBB analysis for core flood line.

4.2.2 Conclusions

While the 1985 SE forwarded to Oconee in 1986 specifically addresses application of LBB technology to Oconee and the adequacy of the leakage detection system, it is not clear that the NRC staff intended to approve the use of LBB technology for Oconee primary loop piping solely based on the SE transmitted to Oconee in February 1986, i.e., further review of the leakage detection systems installed at Oconee based on information submitted by Oconee was suggested. However, the staff relied on the 1985 SE to approve the application of LBB in licensing basis analysis for Framatome Mark-B type fuel assemblies and the licensee modified the Oconee USAR in accordance with 10 CFR 50.59 to reflect the approval of this application of LBB. In addition, prior to the approval of the LPI cross-connect modification, the adequacy of leakage detection system for detecting leaks prior to rupture was evaluated by the NRC staff and found acceptable.

The panel has concluded, based on its review of the documents and interviews with NRC technical staff, that (1) all applications of LBB at Oconee which were submitted to the NRC have been approved by the NRC, and (2) the revision of the Oconee USAR to reflect the approved methodology for applying LBB technology was performed in accordance with the Commissions regulations.

4.3 Issue #3: Process for Resolving Concerns without a DPO

4.3.1 Findings

The panel reviewed efforts to resolve the concerns raised in the DPO that took place before the DPO was submitted. The panel found that a substantial amount of communication took place between the Submitter and staff in NRR on the issues raised in the DPO. For example, the panel reviewed a number of email exchanges between the Submitter and cognizant staff in the NRR Division of Component Integrity (DCI) and records of several telephone conferences coordinated by the NRR Project Manager for Oconee. The panel also reviewed an informal response prepared by NRR staff that addresses the concerns raised by the Submitter adequately. These efforts were substantial; but, they were not effective in resolving the issues.

The panel found that division management in the Region and NRR did not engage in the issues raised in the DPO and the Task Interface Agreement (TIA) process was not used to address the issues raised in the DPO. The TIA process is a management tool used by NRR to address requests for assistance by other NRC Offices, including questions on proper application of regulations or Commission policy. The TIA process is set forth in NRR Office Instruction COM-

106, Rev. 2, dated November 30, 2005. As discussed in COM-106, the process was created to ensure that (1) questions related to potential safety and compliance concerns are appropriately discussed with the requesting organization, (2) the resolutions of the questions are appropriately planned, (3) the issues are adequately evaluated, and (4) the conclusions are reviewed by the appropriate level of management, communicated and documented. The panel reviewed the COM-106, Rev. 2 and confirmed that the issues raised in the DPO fell well within the scope of issues for which the TIA process was created.

4.3.2 Conclusions

Effective interaction between Regional and NRR Division management or the TIA process could have been utilized to address the issues raised in the DPO when they were first raised. A DPO filing may have been avoided.

5.0 Recommendations

The panel has the following recommendation for consideration: The staff should develop a knowledge management document describing the NRC's policy and practice on the application of LBB.

Appendix A
List of Documents Reviewed

NRC Draft Regulatory Guide 1.45; May 1973.

NRC Safety Evaluation of Westinghouse Topical Reports Dealing with Elimination of Postulated Pipe Breaks in PWR Primary Main Loops (Generic Letter 84-04, dated February 1, 1984).

NRC Safety Evaluation of B&W Owners Group Reports Dealing with Elimination of Postulated Pipe Breaks in PWR Primary Main Loops (Letter dated December 12, 1985).

Letter from John F. Stolz (NRC) to Hal B. Tucker (Duke Power Co.); February 18, 1986.

Oconee Station Memorandum to File: OS-196.4, "Oconee Nuclear Station RCL Leak-Before-Break NRC Modification of GDC-4"; June 2, 1986.

"Modification of General Design Criterion 4 Requirements for Protection Against Dynamic Effects of Postulated Pipe Ruptures"; Federal Register; 51 FR 12502; April 11, 1986.

"Modification of General Design Criterion 4 Requirements for Protection Against Dynamic Effects of Postulated Pipe Ruptures"; Federal Register; 51 FR 26399; July 23, 1986.

Draft Standard Review Plan (SRP) Section 3.6.3, "Leak-Before-Break Evaluation"; NUREG-0800; March 1987.

"Modification of General Design Criterion 4 Requirements for Protection Against Dynamic Effects of Postulated Pipe Ruptures"; Federal Register; 52 FR 41294; October 27, 1987.

Memorandum from Robert J. Bosnak (USNRC) to Frederick J. Hebdon (USNRC); Subject: Issues for SRP 3.6.3; February 1, 1988.

"Leak-Before-Break Technology; Solicitation of Public Comment on Additional Applications"; Federal Register; 53 FR 11312; April 6,1988.

Memorandum from James E. Richardson (USNRC) to Frederick J. Hebdon (USNRC), Subject: Ticket 88-10-Issues for SRP 3.6.3; April 14, 1988.

"Policy Statement on Additional Applications of Leak-Before-Break Technology"; Federal Register; 54 FR 18649; May 2, 1989.

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Letter from R.A. Jones (Duke Power Co.) to USNRC, Subject: Supplement to License Amendment Request associated with the Passive Low Pressure Injection Cross Connect Modification, July 22, 2003.

Letter from Leonard N. Olshan (USNRC) to Ronald A. Jones (Duke Power Co.): Subject: Oconee Nuclear Station , Units 1, 2 and 3 RE: Issuance of Amendments (TAC NOS. MB8083, MB8084, AND MB8085); September 29, 2003.

Letter from Leonard N. Olshan (USNRC) to Ronald A. Jones (Duke Power Co.); Subject: Oconee Nuclear Station , Units 1, 2 and 3 RE: Issuance of Amendments (TAC NOS. MC3334, MC3335, AND MC3336); September 2, 2004.

Electronic Mail from Mel Shannon to Michael Ernstes and Robert Carroll; Subject: LBB potential issue; January 24, 2006.

Electronic Mail from Mel Shannon to Kimberly A. Gruss and John Taso; Subject: LBB potential issue; January 25, 2006.

Electronic Mail from Mel Shannon to Kimberly Gruss and Leonard Olshan; Subject: LBB at Oconee; January 26, 2006.

Electronic Mail from Kimberly Gruss to Michael Ernstes; Subject: response to Mel Shannon's questions; January 30, 2006.

NRR Office Instruction "Control of Task Interface Agreements"; COM-106, Rev. 2; November 30, 2005.

Appendix B
List of Individuals Interviewed

July 20, DPO Panel Meeting

Melvin Shannon	NRC Region II
Edmund Sullivan	NRC Office of Nuclear Reactor Regulation

August 15, 2006 Panel Meeting

Edmund Sullivan	NRC Office of Nuclear Reactor Regulation
Timothy Steingass	NRC Office of Nuclear Reactor Regulation
Leonard Olshan	NRC Office of Nuclear Reactor Regulation
Kulin Desai	NRC Office of Nuclear Reactor Regulation
Chang-Yang Li	NRC Office of Nuclear Reactor Regulation
Chia-Fu Sheng	NRC Office of Nuclear Reactor Regulation
Sujit Samaddar	NRC Office of Nuclear Reactor Regulation
Leon Whitney	NRC Office of Nuclear Reactor Regulation
Ralph Architzel	NRC Office of Nuclear Reactor Regulation