

NRC FORM 680 (11-2002) NRCMD 10.159		U.S. NUCLEAR REGULATORY COMMISSION		FOR PROCESSING USE ONLY	
DIFFERING PROFESSIONAL OPINION				1. DPO CASE NUMBER <i>DPO-2006-002</i>	
INSTRUCTIONS: Prepare this form legibly and submit three copies to the address provided in Block 14 below.				2. DATE RECEIVED <i>5/3/2006</i>	
3. NAME OF SUBMITTER Melvin C Shannon		4. POSITION TITLE Senior Resident Inspector, Oconee		5. GRADE GG-14	
6. OFFICE/DIVISION/BRANCH/SECTION USNRC/Region II/DRP/Branch 1/ Oconee		7. BUILDING	8. MAIL STOP	9. SUPERVISOR Michael Ernestes	
10. DESCRIBE THE PRESENT SITUATION, CONDITION, METHOD, ETC., WHICH YOU BELIEVE SHOULD BE CHANGED OR IMPROVED. <i>(Continue on Page 2 or 3 as necessary.)</i> <p>The new ECCS sump screens at Oconee can be impacted by an RCS cold leg break (LOCA). This jet impingement would cause a loss of the sump screen which would lead to a loss of both trains of low pressure injection and both trains of reactor building spray. The loss of these systems would lead to a loss of fuel barrier integrity and loss of containment integrity</p> <p>When NRR was asked by the inspectors about this issue, they stated that "The design basis for the screen does not include pipe break jet impingement loadings and Duke Power was not required to request approval for an exemption to or exemption from GDC-4."</p>					
11. DESCRIBE YOUR DIFFERING OPINION IN ACCORDANCE WITH THE GUIDANCE PRESENTED IN NRC MANAGEMENT DIRECTIVE 10.159. <i>(Continue on Page 2 or 3 as necessary.)</i> <p>The sump screens are an essential part of the ECCS system which is needed to cool the core and prevent over pressurization of containment. Because of screen orientation and proximity to the RCS loops, at Oconee, a LOCA can destroy the sump screens. Without the emergency sump screens, ECCS would be inoperable. It is my opinion that an event (LOCA) should not cause a loss of safety systems needed to mitigate the event (LOCA). In this case the "Leak Before Break" criteria should not be authorized for use by the licensee such that they have blanket approval without any NRC review.</p> <p>It is my opinion that since the new ECCS sump screens can be impacted by a jet from a RCS cold leg LOCA, the licensee should be required to perform an analysis that is reviewed and approved by the staff as required by GDC-4 prior to installation of the screens on Unit 1 and Unit 3.</p> <p>An RCS cold leg LOCA can cause a loss of ECCS. It is my opinion that the NRC should maintain a defense in depth strategy and the ECCS sump screens should be protected from the affects of the LOCA. It is my opinion that an</p>					
12. Check (a) or (b) as appropriate:					
<input checked="" type="checkbox"/> a. Thorough discussions of the issue(s) raised in item 11 have taken place within my management chain; or					
<input type="checkbox"/> b. The reasons why I cannot approach my immediate chain of command are:					
SIGNATURE OF SUBMITTER 		DATE 05/03/2006		SIGNATURE OF CO-SUBMITTER (if any)	
SIGNATURE OF CO-SUBMITTER (if any)		DATE		13. PROPOSED PANEL MEMBERS ARE (in priority order):	
				1. Joe Brady, SRI McGuire	
				2. Jim Tatum, OWFN	
				3. Keith Portner, OWFN	
14. Submit this form to:					
Differing Professional Opinions Program Manager					
Office of: _____					
Mail Stop: _____					
15. ACKNOWLEDGMENT					
THANK YOU FOR YOUR DIFFERING PROFESSIONAL OPINION. It will be carefully considered by a panel of experts in accordance with the provisions of NRCMD 10.159, and you will be advised of any action taken. Your interest in improving NRC operations is appreciated.			SIGNATURE OF DIFFERING PROFESSIONAL OPINIONS PROGRAM MANAGER (DPOPM) 		
			PRE-CONDITIONS MET		DATE OF ACKNOWLEDGMENT
			<input checked="" type="checkbox"/> YES		<input type="checkbox"/> NO
					<i>5/12/2006</i>

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Section 10

The new ECCS sump screens at Oconee can be impacted by an RCS cold leg break (LOCA). This jet impingement would cause a loss of the sump screen which would lead to a loss of both trains of low pressure injection and both trains of reactor building spray. The loss of these systems would lead to a loss of fuel barrier integrity and loss of containment integrity.

When NRR was asked by the inspectors about this issue, they stated that "The design basis for the screen does not include pipe break jet impingement loadings and Duke Power was not required to request approval for an exemption to or exemption from GDC-4."

Section 11

The sump screens are an essential part of the ECCS system which is needed to cool the core and prevent over pressurization of containment. Because of screen orientation and proximity to the RCS loops, at Oconee, a LOCA can destroy the sump screens. Without the emergency sump screens, ECCS would be inoperable. It is my opinion that an event (LOCA) should not cause a loss of safety systems needed to mitigate the event (LOCA). In this case the "Leak Before Break" criteria should not be authorized for use by the licensee such that they have blanket approval without any NRC review.

It is my opinion that since the new ECCS sump screens can be impacted by a jet from a RCS cold leg LOCA, the licensee should be required to perform an analysis that is reviewed and approved by the staff as required by GDC-4 prior to installation of the screens on Unit 1 and Unit 3.

An RCS cold leg LOCA can cause a loss of ECCS. It is my opinion that the NRC should maintain a defense in depth strategy and the ECCS sump screens should be protected from the affects of the LOCA. It is my opinion that an exemption from GDC 4 to use leak before break for the design of the ECCS emergency sump should not be approved for any unit.

Detailed Discussion of Issue

In the design documents for the new emergency sump screens, the licensee noted that jet impingement from a RCS break would cause a loss of the screens and a loss of ECCS functions. The RCS break locations were then eliminated using the LBB process. The Senior Resident Inspector at Oconee considered this to be inappropriate based on the following.

The B&W Owners Group provided an analysis titled "Leak Before Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSS, dated September 1985. This report stated that "the applicability of the LBB concept as discussed in this report focuses on the integrity of the RCS primary piping and does not seek to reduce or redefine GDC-4 LOCA design criteria or qualifications for containment design, release of radioactive materials, and emergency core cooling systems". Based on this statement it appears that it was not intended for LBB to be used to eliminate RCS breaks that could affect the containment structure, containment integrity or the function of the ECCS.

Letters from the NRC to the B&W Owners Group and Oconee, dated December 12, 1985 and February 18, 1986, titled "Safety Evaluation of B&W Owners Group Reports Dealing With Elimination of Postulated Pipe Breaks in PWR Primary Main Loops", both stated "By means of deterministic fracture analyses, the B&W Owners Group contends that postulated double ended

guillotine breaks of the primary loop reactor coolant piping will not occur and therefore need not be considered as a design basis for installing protective devices such as pipe whip restraints to guard against the dynamic effects associated with such postulate breaks. No other changes in design requirements are addressed within the scope of the referenced reports; e.g. no changes to the definition of a LOCA nor its relationship to the regulations addressing design requirements for ECCS (10 CFR 50.46), containment (GDC 16, 50), other engineered safety features and the conditions for environmental qualification of equipment (10 CFR 50.49)."

10 CFR 50.46 states in part that the 50.46 requirements are in addition to the ECCS cooling performance design including in particular Criterion 35 of Appendix A. Criterion 35 requires in part a system to provide abundant emergency core cooling, suitable redundancy in components and features, containment capabilities, and that the system safety function can be accomplished assuming a single failure.

The fact that the ECCS emergency sump can be destroyed by a LOCA, the accident it is supposed to mitigate means that it will not be able to provide abundant emergency core cooling, does not have suitable redundancy, does not maintain its containment capabilities...etc.

The Federal Register for October 27, 1987, documented the Final Rule for modification of GDC 4. In Section II, Final Rule, it was stated that "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." It also states that "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."

Using LBB to eliminate unacceptable impact on the ECCS sump screen is not a negative impact on plant safety. The inconsistency is that the dynamic affects from a LOCA are still maintained for the design of containment structures, environmental qualification of electrical equipment and design of the ECCS, even though the licensees were allowed to use LBB to remove supports and snubbers

In Section VI, Issues Analysis, Issue 4, an industry comment was that "Leak Before Break technology should be extended to relax pipe rupture requirements for containment design, emergency core cooling systems, and environmental qualification of electrical and mechanical equipment." The Commission Response was "The Commission does not intend to consider near term changes to emergency core cooling system and containment design bases as discussed in the final rule section of this supplementary information."

Pipe rupture requirements for containment design are the dynamic affects such as jet impingement missile generation, pipe whip, pressurization...etc. The same logic would hold true for the emergency core cooling system, that is jet impingement, pipe whip,...etc, from a LOCA should not affect the reliability or functioning of the ECCS systems.

In Section II, Scope of Rulemaking, it was stated that "dynamic effects of pipe ruptures in nuclear power plants may be excluded from the design basis..." and "Dynamic effects of pipe rupture covered by this rule are missile generation, pipe whipping, pipe break reaction forces, jet impingement forces, decompression waves within the ruptured pipe and dynamic or nonstatic pressurization in cavities, subcompartments and compartments." It went on to state that "However, cavities, subcompartments, and compartments necessary to the containment function are not

affected by this modification."

This is saying that LBB technology cannot be used to eliminate breaks whose dynamic effects could damage the containment function. Damage to the containment sump, although not directly affecting containment integrity, will lead to a loss of the reactor building spray systems which will lead to containment overpressurization and loss of the containment function.

It went on to document in this section that "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 containment."

The inspector can only conclude that a loss of the ECCS emergency sump screens during a LOCA is a major malfunction within containment.

The following is how the licensee evaluated the new sump screen design:

The licensee performed an evaluation for the new emergency sump screens. This evaluation was performed by Stone and Webster, W.O. number 115524/Calculation S-003. The Objective was to 1) Determine if a rupture of any of the piping systems in the area can impact the design function of the strainer. Under Methodology, it was stated that "a) LOCA - If the pipe rupture causes a LOCA and a jet damages the RBES strainer, the results are unacceptable since the strainer can not be assured to perform its LOCA function." Also, "No new active or passive system failures are introduced by this modification, except if a pipe rupture or jet damages the RBES strainer during response to a LOCA event. The (old) strainer was generally shielded from jets in the original design by the sump walls since the strainer was below the floor level and there is floor decking above the strainer (screen)." The evaluation concluded that The RCS cold legs did not pose a threat to the RBES sump screens in that "No pipe breaks due to LBB criteria."

The licensee provided a response to GL 2004-02. In the response dated September 1, 2005, the licensee stated that "The jet impingement evaluation of the new strainer design, crediting Leak Before Break, concluded that there are no credible HELB jets that could damage the strainer when needed during a LOCA."

The inspector contacted NRR and the following was provided:

In the E-mail, dated 1/30/06, (attached) from K. Gruss, it was stated that "In the case of Oconee's new sump screen design, the design basis for the screen does not include pipe break jet impingement."

However, as noted above, the Oconee engineering evaluation concluded that jet impingement could render the sump screens inoperable. It went on to use LBB to eliminate the jet impingement on the screens and to conclude based on this elimination that the new screen design was acceptable. 10 CFR 50, Appendix A, Criterion 35, Emergency Core Cooling, states that "Suitable containment capabilities shall be provided to assure the system safety function can be accomplished." I can only conclude that jet impingement is a design consideration. Stating that a LOCA can destroy the ECCS sump screens and this is not included in the design basis for the ECCS sump screens appears to be wrong.

NRR was asked to evaluate the new sump design based on using LBB prior to installation of the

new sump screens:

Headquarters was asked by the inspectors to evaluate the new sump design based on applicability of the LBB criteria and the fact that LBB criteria may not have been met (prior to the new sump screen installation in Unit 2). A Safety Evaluation, dated November 1, 2005, was sent to the licensee following inspections of the sumps by NRR. The evaluation stated that "The information that was provided by the licensee regarding jet impingement and pipe whip effects, and missile protection, will be reviewed as part of this action plan." (GL 2004-02 response). However, even though the concern with leak before break and the effects on the new sump screen design, NRR stated in the SER that "The NRC staff concludes that there are no credible missiles nor credible high energy line break jets or pipe whips that could damage the strainer when needed during a LOCA." This statement was based on the licensee's evaluation that used LBB criteria to eliminate RCS cold leg breaks.

Conclusion:

It appears that the ECCS should be protected from the affects of jet impingement and that LBB criteria are not appropriate to eliminate the jet impingement from a cold leg RCS break. Prior approval would be needed.

It is unreasonable to me that the licensee can use LBB to install a sump screen that cannot even meet the basic single failure criteria of Criterion 35 and is subject to jet impingement that could destroy the screens during the design event they are supposed to be available to mitigate.

It is the inspectors opinion that NRR should require an exemption to use LBB for the emergency sump modification. It is the inspectors opinion that the risk of RCS break and loss of the emergency sump poses a threat to safety and the use of LBB should not be approved. Barriers or deflection shields should be installed to deflect RCS cold leg jet impingement away from the screens. This is not an unreasonable or expensive request.

Assessment of consequences if position is not adopted:

Ocone will not be able to mitigate a Large Break Loss of Coolant Accident if the break impinges on the emergency sump screen. This will cause a loss of Low Pressure Injection and Reactor Building Spray systems. Loss of these systems will lead to significant fuel damage and loss of containment. In effect, the LPI system may not be able to mitigate the accident it was designed to mitigate.