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AUTH.NAME	AUTHOR AFFILIATION
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RECIP.NAME	RECIPIENT AFFILIATION

SUBJECT: LER 90-015-00:on 901119,B&W confirmed that current Tech Spec allowances for operation below 60% full power inadequate under assumed conditions.Caused by design deficiency & design oversight.W/901220 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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DUKE POWER

December 20, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/90-15

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/90-15 concerning unit operation in an unanalyzed condition due to design deficiency, design oversight.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(ii)(A). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

H. B. Barron
Station Manager

RSM/ftr

Attachment

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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	1 OF 0 9

TITLE (4) Unit Operation in an Unanalyzed Condition Due to Design Deficiency, Design Oversight

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
1 1	1 9	9 0	9 0	— 0 1 5 —	0 0	1 2	2 0	9 0	Oconee, Unit 2	0 5 0 0 0 2 7 0
									Oconee, Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9): N

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[X] OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	50.72(B)(1)(ii)(A)
[ ] 20.405(a)(1)(iv)	[X] 50.73(a)(2)(ii)(A)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	
Henry R. Lowery, Chairman Oconee Safety Review Group	8 0 3	8 8 5 - 3 0 3 4

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES *(If yes, complete EXPECTED SUBMISSION DATE)* [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines)* (16)

On November 16, 1990, with all three Units at 100 percent full power, a Design Engineer discovered that the requirements specified by Technical Specification 3.3.1 for High Pressure Injection System (HPI) operation below 60 percent full power could potentially result in insufficient Emergency Core Cooling System flow for certain HPI line break assumptions. The Design Engineer, while reviewing HPI system operation in order to respond to questions raised on another issue, realized that if an HPI line broke at the Reactor Coolant System injection nozzle, less flow would reach the Reactor Coolant System than had been previously analyzed. Design Engineering contacted Babcock and Wilcox (B&W) and requested them to assess the potential for reduced HPI System flow during the postulated line break. On November 19, 1990, at 1600 hours, B&W confirmed that the current Technical Specification allowances for operation below 60 percent full power are inadequate under the assumed conditions. Additional requirements for HPI System operation below 60 percent full power were initiated to conservatively ensure adequate HPI flow. Because the original evaluation of the Emergency Core Cooling System did not identify the consequences of this potential HPI line break, this event is assigned a root cause of Design Deficiency, Unanticipated Interaction Of Systems, Design Oversight.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	9 0	— 0 1 5 —	0 0	0 2 OF 0 9

TEXT (If more space is required, use additional NRC Form 366A's) (17)

BACKGROUND

The High Pressure Injection (HPI) System [EIIS:BQ], during normal operation, controls the Reactor Coolant System (RCS) [EIIS:AB] inventory, provides the seal water for the Reactor Coolant Pumps [EIIS:P], and recirculates RCS letdown for water quality maintenance and reactor coolant boric acid concentration control.

The HPI System is also a part of the Emergency Core Cooling System (ECCS) which mitigates loss of coolant accidents (LOCA). The HPI System prevents uncovering of the core for smaller break sizes, where high system pressure is maintained, and delays the uncovering of the core for intermediate break sizes. The HPI System, during emergency operation, supplies borated water to the RCS from the Borated Water Storage Tank (BWST). The HPI System has three parallel HPI pumps that have the capability to take suction from the BWST. The HPI pumps have the capability to discharge through two redundant flow paths into the RCS, utilizing four injection nozzles (two per flowpath). The injection nozzles are located on each of the reactor inlet pipes downstream of the Reactor Coolant Pumps (See Attachments 1&2). Additionally, each HPI flowpath is connected together by piping and associated valves at each HPI pump discharge header. This cross connect provides for remote manual alignment to ensure flow to the core through both HPI trains should a single failure of a HPI pump or HPI injection valve prevent automatic injection through one train.

Technical Specification 3.3.1 requires three HPI pumps and two HPI flow paths to be operable during power operation above 60 percent full power. Additionally, the valves in the cross connect must also be operable. This is based on considerations of potential small breaks at the Reactor Coolant Pump discharge piping for which two HPI trains (two pumps and two flow paths) are required to assure adequate core cooling. Based on the current analysis of these breaks for operation below 60 percent full power, only a single train of the HPI System is needed to provide adequate core cooling. Therefore, Technical Specification 3.3.1 requires two HPI pumps and two flow paths to be operable when the RCS temperature is greater than 350 degrees F and reactor power is less than 60 percent full power. The cross connect and the third HPI pump are not required for unit operation below 60 percent power.

The current Technical Specification requirements are based on a Small Break LOCA scenario initiating with a worst single failure resulting in one HPI pump injecting into two RCS cold legs. The break, being postulated to occur in one cold leg at the Reactor Coolant Pump discharge, results in part of the HPI flow going out the break while the remainder enters the RCS through the intact cold leg. Because both injection points are exposed to RCS pressure, there is an equal split of the flow with half going out the break and half entering the RCS.

TEXT (If more space is required, use additional NRC Form 366A's) (17)

EVENT DESCRIPTION

Prior to the operation of any Oconee Unit, the Reactor Coolant System (RCS) was analyzed for failures of the RCS pressure boundary that would result in the loss of primary coolant. Additionally, the Emergency Core Cooling System (ECCS) was analyzed (documents BAW-10103 and BAW-10052) for its response to Loss Of Coolant Accidents (LOCA) by Babcock and Wilcox (B&W). Based on these analyses the Technical Specification 3.3.1 requirements for operating the High Pressure Injection (HPI) System were developed. The original Technical Specifications for the HPI System required two HPI pumps to be operational during power operation.

In December 1974, in a supplement to the Topical Report BAW-10091, Supplement 1 "Supplement And Supporting Documentation For B&W's ECCS Evaluation Model Report With Specific Applications To 177-FA Class Plants With Lowered-Loop Arrangement", B&W responded to a question on the consequences of a HPI line break. The response stated that Oconee Units 1,2 & 3 contained orifices in the HPI lines and that "These orifices prevent the full loss of the injection water to the reactor building." Additionally, the response stated that "the flow which reaches the reactor vessel is sufficient to keep the core completely covered with water."

In April 1978, it was realized that for a Small Break LOCA that would not depressurize the RCS below the point of initiation of other ECCS Systems, only one half of one HPI train was available if a break is assumed to be in the RCS cold leg down stream of the Reactor Coolant Pump discharge. This was identified as an unacceptable scenario and reported (Report 269/78-11) to the NRC. In order to deliver the required injection flow, the HPI System was modified on all Oconee Units to include a cross connect between the HPI pump discharge lines. Technical Specification 3.3.1 was revised in 1978 to include provisions for enhanced operation of the HPI System above 60 percent full power. The April 20, 1978, Technical Specification submittal stated that "at or below 60 percent full power only a single train of the HPI System is needed to provide the necessary core cooling."

In January 1979, Design Engineering evaluated the HPI System with respect to HPI flow requirements. This evaluation was performed to verify that the cross-connect modification to the HPI System would provide sufficient flow. B&W stated in a May 10, 1978, letter to Duke Power that "70 percent of 500 gpm at 600 psig effective HPI flow would allow 100 percent power operation". Design Engineering understood this flow requirement of 350 gpm to be applicable to all Small Break LOCAs. Actually, the 350 gpm assumption was valid for pump discharge breaks. In order to yield the most conservative flow split, the Duke evaluation of the HPI System assumed a break in one of the four injection lines. The flow split calculation assumed that this line was exposed to atmospheric pressure. Since the HPI evaluation was concerned with full power HPI requirements, the flow split calculation took credit for two HPI pumps injecting through two trains. The results of this evaluation indicated that the HPI flow delivered to the RCS significantly exceeded the Small Break LOCA requirement of 350 gpm. An evaluation of HPI flow requirements at reduced power levels was not performed at this time due to the May 10, 1978, B&W letter which stated that one HPI pump injecting through one train provided adequate HPI flow below 60 percent full power.

In early November 1990, a Design Engineer was assigned the task of evaluating problems that had been identified as a result of a Self Initiated Technical Audit of the HPI System, concerns expressed by Oconee Operations personnel and evaluations related to HPI flow instrument requirements for Regulatory Guide 1.97.

On November 16, 1990, the Design Engineer was studying historical records to gain a better understanding of the HPI System flow requirements so that he could respond to the problems that had been identified. During this review, he recognized that the April 1978 Technical Specification submittal did not appear to consider the consequences of a break in the HPI line between the last HPI check valve and the RCS injection nozzle. The 1978 B&W analysis, for cross-connected HPI trains, was based on 70 percent of the HPI flow reaching the core. However this flow split was based on all four injection lines seeing the same RCS pressure. However, the postulated HPI line break identified by the Design Engineer would result in one of the four injection points being exposed to reactor building pressure while the other three injection points would be exposed to RCS pressure. After evaluating the Technical Specification requirement for operation above 60 percent full power and based on the fact that operator action would result in two HPI pumps injecting through two trains, the flow requirements for the HPI line break scenario were easily satisfied following manual cross connection of the HPI trains. However, the Technical Specification only requires two HPI trains to be operable below 60 percent full power. In addition, the valves needed to cross-connect trains do not have to be operable below 60 percent full power. Thus, it is conceivable that a Small Break LOCA with a worst single failure could result in only one HPI pump injecting through one train where one of the two injection nozzles is broken. This appeared to result in inadequate HPI flow being delivered to the RCS. The Design Engineer contacted B&W and requested them to assess the impact of the potential for reduced HPI System flow during this postulated line break.

On November 19, 1990, at 1600 hours, B&W responded in a telephone conversation confirming that one HPI pump operation, as allowed by the current Technical Specification for operation below 60 percent full power, is inadequate under the assumed conditions. Additional operability requirements for HPI System operation below 60 percent full power were initiated to conservatively ensure adequate HPI flow. These additional requirements include the operability of three HPI pumps, two flow paths, and the cross connect when the RCS is greater than 350 degrees Fahrenheit with fuel in the core. They will be imposed until an analysis is performed defining HPI operability requirements at reduced power, with NRC approval as necessary.

CONCLUSIONS

The original 10CFR50.46 analysis of Oconee's Emergency Core Cooling System (ECCS) as reported in Babcock and Wilcox (B&W) documents BAW-10103, revision 3 and in BAW-10052 assumed the most limiting Small Break Loss Of Coolant Accident (LOCA) was at the suction of the Reactor Coolant Pumps. No documentation for this time frame could be found that indicates that a break in a High Pressure Injection (HPI) line was considered.

The earliest documentation found addressing the consequences of a LOCA with the worst single failure for a HPI injection line was found in B&W's 1974 supplement to the Topical Report, BAW-10091, Supplement 1 "Supplement And Supporting Documentation For B&W's ECCS Evaluation Model Report With Specific Applications To 177-FA Class Plants With Lowered-Loop Arrangement". The response stated that Oconee Units 1,2 & 3 contained orifices in the HPI lines and that "These orifices prevent the full loss of the injection water to the reactor building". Additionally, the response stated that the flow which reaches the reactor vessel is sufficient to keep the core completely covered with water. The B&W response does not mention the HPI flow assumptions or configuration, however, based on assumed single failure and Oconee's Technical Specification requirements it appears that this response was addressing flow from one HPI pump through one HPI train. While this document indicates that a break of the HPI line was considered, no analysis has been located that substantiates the conclusion.

In April 1978, B&W, while performing 10CFR50.46 analysis for other B&W plants using an updated evaluation model, found that the limiting Small Break LOCA for the ECCS was in the Reactor Coolant System (RCS) cold leg down stream of the Reactor Coolant Pump discharge. While documentation for this incident stated that "a spectrum of small breaks has been examined" no indication was found that a break in the HPI injection line was considered.

The January 1979, evaluation by Design Engineering did consider a Small Break LOCA in one of the HPI System injection lines, however, this evaluation was for full power operation. Design Engineering did not consider evaluating this scenario for HPI System operation below 60 percent full power.

The current evaluation confirms that past Technical Specification requirements allowed an alignment of the HPI System that would not provide adequate core cooling under the postulated HPI line break scenario. Since initial power operation of the Oconee Units, operation in this unanalyzed configuration has occurred. Although documentation exists that indicates that an HPI injection line break was considered as early as 1974, no documentation has yet been found to indicate that this scenario was analyzed for operation at any power level prior to 1979 and for operation below 60 percent full power after 1979. Therefore, this event is assigned a root cause of Design Deficiency, Unanticipated Interaction Of Systems, Design Oversight.

Since the original 10CFR50.46 evaluation of Oconee, new programs have been initiated and existing programs have been enhanced resulting in the improved frequency, level of detail and accuracy of the evaluations/analyses for Oconee. These new programs would preclude the probability of similar occurrences. The initiation of the additional operability requirements for HPI System operation below 60 percent full power will conservatively ensure adequate HPI flow.

A review of LERs over the past two years found no other similar events that involved the same equipment, work function or personnel. Therefore, this event is considered non-recurring. There was no equipment failure or malfunction associated with this event, therefore it is not NPRDS reportable. There were no uncontrolled releases of radioactive materials, radiation overexposures, or personnel injuries associated with this event.

CORRECTIVE ACTIONS

Immediate

1. Administrative controls to require additional operability requirements for High Pressure Injection (HPI) System operation below 60 percent full power were initiated to conservatively ensure adequate HPI flow.

Subsequent

2. A Technical Specification Interpretation to require additional operability requirements for HPI System operation below 60 percent full power was initiated to conservatively ensure adequate HPI flow.

Planned

1. Revise the Technical Specification 3.3.1 and Final Safety Analysis Report as necessary.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	9 0	0 1 5	0 0	0 7 OF 0 9

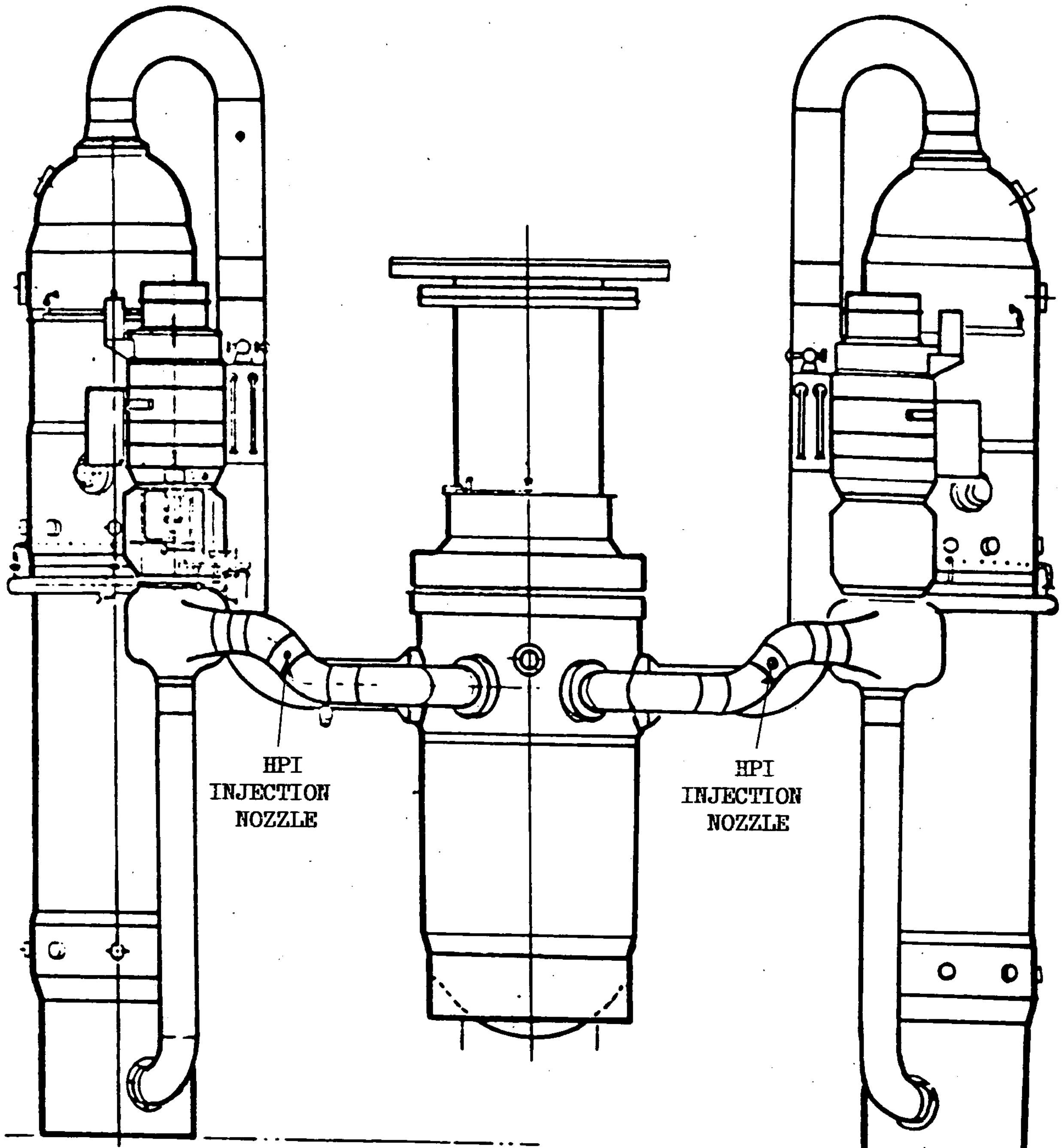
TEXT (If more space is required, use additional NRC Form 366A's) (17)

SAFETY ANALYSIS

The High Pressure Injection (HPI) System is part of the Emergency Core Cooling System (ECCS), which mitigates loss of coolant accidents (LOCA) and other FSAR Section 15.0 accidents. The HPI System prevents uncovering the core for small coolant piping leaks where high system pressure is maintained, and delays uncovering the core for intermediate sized leaks. The HPI System utilizes four injection nozzles that are supplied by two flow paths (two per flowpath) and three HPI pumps in carrying out the high pressure injection function. If a small break LOCA occurs in one of the two HPI injection lines between the cold leg nozzle and the HPI check valve, this HPI line would be exposed to atmospheric pressure. This scenario would result in less than 50 percent of the HPI flow for that flowpath reaching the Reactor Coolant System (RCS). However, evaluation indicates that the HPI flow delivered to the RCS with two pumps injecting through two flow paths exceeds the HPI flow requirements for this HPI line break from full power. Although the Technical Specification allows for reduced HPI operability during power operation below 60 percent power, Oconee normally operates with all HPI pumps, flow paths and cross connects operable during all power operating ranges. By applying the current Technical Specification requirements for operation above 60 percent full power to all operating conditions, as has been done due to this event, availability of sufficient HPI flow is ensured for any accident sequence, thereby, satisfying the core cooling requirements.

Over the life of Oconee, while no incident has been identified, power operation below 60 percent power with two HPI pumps has occurred on Oconee Units. These periods of operation represent only a small portion of the time Oconee has been operating, therefore, the probability of this scenario (Small Break LOCA occurring between the RCS injection nozzle and the HPI check valve in combination with the worst single failure of the HPI System) occurring at power operation below 60 percent full power was very small. If this scenario had occurred during one of these periods the core would have been partially uncovered with the potential for core damage. However, this scenario would result in less severe consequences than those postulated by the Maximum Hypothetical Accident (MHA) which has been analyzed with having effects below the limits of 10CFR100. Since this postulated small break did not occur during a time when two HPI pumps were in operation and its consequences are less severe than the MHA if it had occurred, the health and safety of the public was not jeopardized as a result of this event.

ATTACHMENT 1



TITLE:	NOTES:	
Reactor Coolant System	RCS - Piping	ID NO OC-PNS-RCS-3 DATE: 8-20-
		REF. F.S.A.R.
		DRN. BY: DMC/ARB APPR. BY: RPB
		TRAINING USE ONLY

- 9 -

ATTACHMENT 2