Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

April 22, 1996
3F0496-26

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Subject: Licensee Event Report (LER) 95-026-01

Dear Sir:

Please find the enclosed Licensee Event Report (LER) 95-026-01. This supplement is submitted by Florida Power Corporation in accordance with 10CFR 50.73. It includes the results of hydraulic analyses to determine High Pressure Injection (HPI) pump runout limits in maximum bounding flow scenarios along with resulting corrective actions.

Sincerely,

E. J. Hickle

E. J. Hickle, Director
Nuclear Plant Operations

TWC/lf

Attachment

xc: Regional Administrator, Region II
Project Manager, NRR
Senior Resident Inspector

IE22 1/

NRC FORM 366 (5-92)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HOURS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
CRYSTAL RIVER UNIT 3 (CR-3)	0 5 0 0 0 3 0 2	1 OF 0 8

TITLE (4)

Unqualified Flow Instrument Used in Determining HPI Pump Runout Conditions Caused by Failure to Recognize Applicability of Reg Guide 1.97

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
									N/A	0 5 0 0 0
1 1	0 7	9 5	9 5	0 2 6	0 1	0 4	2 2	9 6	N/A	0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (CHECK ONE OR MORE OF THE FOLLOWING) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	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)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	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
T.W. Catchpole, Sr. Nuclear Licensing Engineer	3 5 2 5 6 3 - 4 6 0 1

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

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

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On November 7, 1995, Florida Power Corporation's Crystal River Unit 3 was in MODE ONE (POWER OPERATION), operating at 100% reactor power and generating 882 megawatts. Engineering personnel determined that operators used an unqualified reactor coolant pump (RCP) seal injection flow instrument to aid in preventing High Pressure Injection (HPI) pump runout conditions. HPI flow to the RCP seals was in addition to HPI flow measured by R.G. 1.97-qualified instrumentation and did not appear to have been considered in analyses for the HPI pumps with respect to possible runout conditions. Subsequent to reporting of the event, hydraulic analyses were located which addressed RCP seal injection flow. Additional analysis has been performed which concluded pump runout is not a concern under worst case conditions except during "piggyback" alignment (HPI pump suction from Low Pressure Injection pump discharge). The cause of this event was failure to update R.G. 1.97 Type A Variable reviews as changes were made to Emergency Operating Procedures (EOP). A new commitment has been established to ensure these reviews will be accomplished in the future. In addition, EOP's will be revised prior to startup from the current refueling outage (10R) to require isolation of RCP seal injection if adequate subcooling margin is lost and to throttle HPI flow during piggyback alignment if pump runout is being challenged.

EVENT DESCRIPTION

On November 7, 1995, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE ONE (POWER OPERATION), operating at 100% Reactor Power and generating 882 megawatts. During a review of Emergency Operating Procedure (EOP) setpoints under the EOP Enhancement Program - Phase 2, FPC Engineering personnel discovered a discrepancy regarding FPC's commitments to Regulatory Guide (R.G.) 1.97 "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident". The EOP Enhancement Program was developed as a result of NRC Inspection 93-16 and a variety of self-identified weaknesses. It is an effort to reconstitute the bases for the guidelines contained in the EOP's. In this event, engineering personnel noted that operators must rely on a non-safety, non-qualified flow indicator [CB,FI] (MU-27-FI) to measure high pressure injection [BQ](HPI) flow through Reactor Coolant (RC) Pump [AB,P] seal injection lines and to ensure HPI flow is within the runout capacity of the HPI pumps. The flow measured by MU-27-FI is in addition to the flow measured by qualified instrumentation in the HPI lines and, at the time of the discovery of this event, did not appear to have been considered in makeup system hydraulic analyses. It was further identified that total HPI pump flow is limited in the EOP's to 540 gallons per minute (gpm) per running pump. Adding instrument error of 34 gpm yields a total HPI flow of 574 gpm which is just below the established HPI pump runout limit of 575 gpm. As a result, it was determined that, when operators are called upon to throttle HPI flow per EOP-13 "EOP Rules", the lack of qualification of the RC pump seal injection flow measurement during post accident conditions could result in Makeup Pump [CB,P] runout flow being exceeded.

A Problem Report was issued on November 7, 1995 to identify the failure to classify MU-27-FI as a R.G. 1.97 Type A, Category 1 instrument (these terms are defined in Attachment 1). The Problem Report was initially determined to be not reportable; however, an operability assessment was conducted in accordance with Compliance Procedure CP-150, "Identifying and Processing Operability Concerns." This procedure provides a structured approach toward determining the OPERABILITY of plant components required for accident mitigation and safe shutdown of the plant and provides guidelines to ensure no loss of plant system or component safety function. The assessment resulted in the determination that the HPI system was "operable but degraded" and a Justification for Continued Operation (JCO) was developed which involved the issuance of Short Term Instruction 95-0061. The instruction modifies the guidance in EOP-13 and requires operators to isolate the seal injection lines whenever full HPI is required, thereby removing the non-qualified device from being used by operators in assessing total HPI flow during accident scenarios. An Event Notification was made to NRC at 1343 on November 10, 1995 using the Non-Emergency Event Notification system in accordance with 10CFR50.72(b)(2)(iii)(D). Event Number 29582 was assigned.

This report is being submitted in accordance with 10CFR50.73(a)(2)(v)(D) as a condition that could have prevented the fulfillment of the safety function to mitigate the consequences of an accident.

EVENT EVALUATION

During normal reactor operation, the Makeup and Purification System [CB] (MU) recirculates reactor coolant [AB] for purification and for supply of seal water to the Reactor Coolant Pumps (RCPs). The high pressure injection [BQ] (HPI) function of the MU System provides emergency core cooling to prevent uncovering the core during RC System small break loss-of-coolant-accidents (SBLOCA). Final Safety Analysis Report (FSAR) Section 6.1.3 states that two HPI pumps are normally actuated upon receipt of an Engineered Safeguards [JF] (ES) initiation signal. Each pump has its discharge throttled to deliver approximately 500 gpm when the RCS is at 600 psig. The safety analysis in Chapter 14 of the FSAR has shown that one HPI pump is sufficient to prevent core damage for those smaller leak sizes which do not allow the RCS pressure to decrease rapidly to the point at which Low Pressure Injection [BP] (LPI) is initiated.

HPI will automatically actuate on an RCS pressure of 1500 psig, and on a Reactor Building Isolation and Cooling [JM] (RBIC) Actuation of 4 psig in the containment [NH]. Automatic actuation of the valves and pumps by the actuation signals switches the system from its normal operating mode (MU) to the emergency operating mode (HPI) to deliver borated water into the reactor vessel [RPV] through the reactor coolant cold leg piping. See Figure 1.

The revision of Emergency Operating Procedure EOP-13 in effect at the time of the event stated that, in addition to protecting Nil Ductility Temperature (NDT) limits due to the possibility of vessel failure by brittle fracture, HPI must also be throttled to prevent pump runout. Step 2 of EOP-13 Rule #2 "HPI Control" instructed operators to throttle HPI flow to 540 gpm per running pump to prevent pump runout. CR-3 has three MU Pumps (MUP-1A,1B,1C), two of which are required for HPI. The design basis for these pumps is based on vendor correspondence and actual test data and states that the maximum allowable flow through each pump is 575 gpm without instrument error correction.

HPI injection valves [BQ,FCV] MUV-23, 24, 25, & 26 are normally closed and receive an open command when HPI is actuated. When open, these valves direct the discharge of the MU pumps into the RCS cold legs at a point between the RCPs and the Reactor Vessel. To ensure adequate HPI flow in the event of a nozzle line break on one of the four HPI injection nozzles, previous guidance indicated the operator must monitor and balance HPI flow through the injection lines. Indication of HPI flow is provided to the operator via flow indicators [BQ,FI] MU-23-FI1, FI2, FI3, and FI4.

Each RCP seal package receives 8 to 10 gpm injection flow during normal operation. Of this flow, all but approximately one gpm flows into the RCS along the pump shaft. The remaining one gpm flows up along the shaft seals to stage, cool, and lubricate them. This one gpm flow from each pump is routed to a common return line and along with the recirculation flow from the makeup pump, flows through one of the two seal return coolers and back to the Makeup Tank [CB,TK] (MUT). Flow Indicator MU-27-FI provides indication to the operators of reactor coolant total seal flow. The indication alerts the operator of abnormal flow conditions to the RCP seals.

Prior to 1989, HPI balancing was not considered necessary for a HPI line break because the distance between the last check valve in the HPI line before injection into the RCS was small. Reconsideration of that criteria in 1989 led to the incorporation of HPI balancing and throttling as a Type A variable action and an analysis of HPI flow requirements for the HPI line break scenario. FPC's analysis is based on a detailed Babcock & Wilcox (B&W) calculation which assumes that RCP Seal Injection flow is open during the HPI line break, but does not take credit for the flow as a conservative assumption. The focus of the analysis and calculation was on minimum HPI flow requirements for design basis scenarios, not potential pump runout concerns.

Subsequent to the notification of this event, nuclear design engineering personnel located the specific CR-3 Makeup System Hydraulic Analysis which contains a section for analyzing the HPI system for maximum Diesel Generator [EK,DG] loading. The scenario analyzed is for a HPI line break with one or two pumps operating. Open flow paths in this analysis include the Seal Injection Line and the normal Makeup flow path in addition to the 4 HPI injection lines. Maximum water levels for the Borated Water Storage Tank [BP,TK] and Makeup Tank are also used. RC System pressure is 200 pounds per square inch gauge (psig). In the limiting case for HPI pump runout (one pump running), the maximum flow developed per this model is 554.9 gpm. Given that HPI pump runout does not occur until 575 gpm, and since all of the conditions associated with the model were conservative except for RC system pressure, engineering personnel reasoned that HPI pump runout may not be credible for the existing system configuration. Engineering cited the fact that Makeup Pump discharge stop check valves [BQ,V] are set to limit pump flow to 500 gpm at a RC System pressure of 600 psig and the above hydraulic analysis considers RC System pressure at 200 psig. Therefore, the only remaining question requiring analysis regarding HPI Pump runout was for pressures below 200 psig which allows HPI termination and at which minimum Low Pressure Injection (LPI) flow rate is established. As noted in the Additional Corrective Actions section of this report, a hydraulic computer model has been run to resolve the HPI pump runout concerns.

CAUSE

The primary cause for this event is that, as more specific design basis information has been included in the Emergency Operating Procedures (EOP's), a corresponding update of Type A Variable reviews have not always been performed.

IMMEDIATE CORRECTIVE ACTION

Short Term Instruction (STI) 95-0081 was issued on November 10, 1995 with an effective date until February 8, 1996 instructing operators to isolate the RCP Seal Injection line whenever full HPI is required. This STI removed uncertainty about HPI pump flow pending resolution of issues involving qualification of MU-27-FI. A subsequent STI (96-0008) was issued on February 6, 1996 to ensure seal injection was isolated during full HPI until permanent procedure revisions could be issued.

ADDITIONAL CORRECTIVE ACTION

1. MU-27-FI will be incorporated into a study to determine the need to upgrade/change instrumentation used on the Engineered Safeguards (ES) Section of the Main Control Board [MCBD]. This study was initiated as a result of another Problem Report involving EOP setpoints, and is intended to include all the findings from the EOP reviews currently ongoing that impact R.G. 1.97 instruments on the Main Control Board. The EOP Review Program should be sufficiently complete by April, 1996 to enable the above study to be initiated by August 1, 1996.

2. The MU System Hydraulic Analysis has been modified to include bounding maximum flow scenarios for the existing CR-3 Emergency Core Cooling System (ECCS) configurations. The model includes the "piggyback" alignment (HPI pump suction from LPI pump discharge) and was run with RCP Seal Injection open. With the RCS at 0 psig, the maximum expected flow is approximately 579 gpm. This is a concern with RCP Seal Injection open and no throttling of HPI flow. With RCP Seal Injection closed and throttling HPI flow to 540 gpm, it would not be possible to exceed 575 gpm even when considering instrument error.

3. Short Term Instruction STI 96-0008 was removed from the Control Room on February 26, 1996. A requirement to isolate seal injection anytime subcooling margin is lost will be added to EOP-03 prior to reaching MODE 4 (HOT SHUTDOWN) during startup from the current refueling outage (10R).

4. HPI pump runout limits will be added to EOP-07 "Inadequate Core Cooling and EOP-08 "LOCA Cooldown" prior to achieving MODE 4 during startup from the current refueling outage (10R) to require operators to monitor for this condition when aligning for piggyback operation, and to throttle HPI flow if the HPI flow instruments indicate runout is being challenged. HPI pump runout limits have been removed from EOP-13, Rule 2 to ensure maximum available core cooling during SBLOCA's. Justification to remove these limits is based on the hydraulic analysis that demonstrated runout is not a concern except in piggyback operation.

5. Operator training on use of EOP's revised as a result of this LER will be accomplished prior to starup from the current refueling outage (10R).

6. Changes will be made by July 1, 1996 to training lesson plans and simulator training to eliminate concerns regarding HPI pump runout.

7. Babcock & Wilcox Document 32-1174002-00 "HPI Pinch Break Analysis" has been incorporated into the CR-3 Calculation system along with the analyses of flow conditions performed as a result of this event.

8. The Configuration Management Information System (CMIS) has been updated to add calculation references to affected components.

ACTION TO PREVENT RECURRENCE

A new commitment has been added to the Nuclear Operations Control System (NOCS) to require a review for EOP changes to ensure that any Type A variables that have been added or deleted, are evaluated for corresponding changes to the Type A Variable Study. The commitment also addresses the need to modify any affected instrument string as necessary.

PREVIOUS SIMILAR EVENTS

There has been one similar event involving HPI Pumps and flow instrumentation. LER 89-37 reported instrumentation accuracy inadequacies to perform flow balancing during an HPI Line Break. As part of the corrective action for the LER, a review was performed of the effects of HPI line pinch and guillotine breaks such as HPI flow to the core and HPI pump runout, No additional procedure or plant changes were identified beyond addition of qualified flow instruments.

ATTACHMENT

Attachment 1 -Abbreviations, Definitions and Acronyms

ATTACHMENT 1 - ABBREVIATIONS, DEFINITIONS AND ACRONYMS

Category 1	These R.G. 1.97 measurements are key variables with the most stringent requirements.
CR-3	Crystal River Unit 3
ECCS	Emergency Core Cooling Systems
EOP	Emergency Operating Procedure
FPC	Florida Power Corporation
HPI	High Pressure Injection
LPI	Low Pressure Injection
MODE ONE	POWER OPERATION (Greater Than 5 Percent Rated Thermal Power)
MU	Makeup and Purification System
Problem Report	Documents a condition or event which warrants evaluation, root cause analysis, or corrective actions beyond what it would receive if documented and processed by other methods.
R.G. 1.97	"Instrumentation for Nuclear Power Plants to Assess Plant and Environs Conditions During and Following and Accident"
Runout	Operation of a pump beyond its design capacity; indicated by a decrease in discharge head and excessive power consumption.
SBLOCA	Small Break Loss-of-Coolant Accident
Type A	Those plant specific variables described in R.G. 1.97 that provide primary information needed to permit the control room operator to take the specified manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety function for design basis accident events.

NOTES: ITS defined terms appear capitalized in LER text (e.g. MODE ONE)

Defined terms/acronyms/abbreviations appear in parentheses when first used (e.g. Reactor Building (RB)).

EIIS codes appear in square brackets (e.g. Makeup Tank [CB,TK])

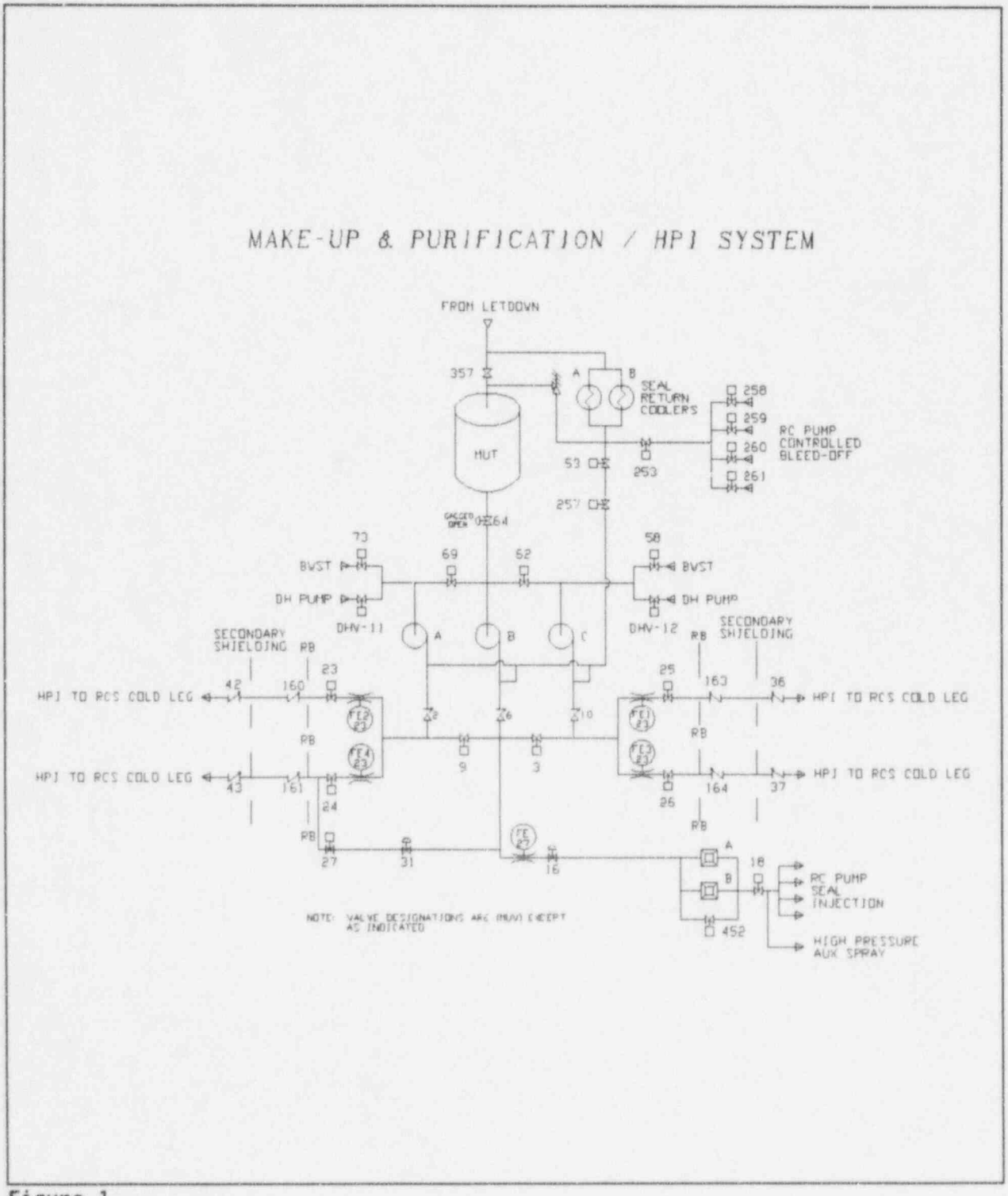
MAKE-UP & PURIFICATION / HPI SYSTEM
FROM LETDOWN
357
A
B
SEAL RETURN COOLERS
258
259
260
261
RC PUMP CONTROLLED BLEED-OFF
MUT
53
253
257
264
73
69
62
58
BWST
DH PUMP
DHV-11
DHV-12
A
B
C
SECONDARY SHIELDING
RB
23
42
160
HPI TO RCS COLD LEG
43
161
24
27
31
9
3
2
6
10
16
25
163
36
164
37
26
18
452
RC PUMP SEAL INJECTION
HIGH PRESSURE AUX SPRAY
NOTE: VALVE DESIGNATIONS ARE (MUV) EXCEPT AS INDICATED

Figure 1