UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-348/90-24 and 50-364/90-24

Licensee: Alabama Power Company
600 North 18th Street
Birmingham, AL 35291-0400

Docket Nos.: 50-348 and 5-364 License Nos.: NPF-2 and NPF-8

Facility name: Farley 1 and 2

Inspection Conducted August 27 - 31, 1990

Inspector: George Hallstrom 9/14/90
G. A. Hallstrom Date Signed

Approved by: GA Belisle 9/14/90
G. A. Belisle, Chief Date Signed
Test Programs Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection examined licensee actions in response to NRC Inspection and Enforcement Bulletin (IEB) 88-04, "Potential Safety-Related Pump Loss." The bulletin requested the licensees to determine if any operational safety-related systems would result in dead-heading, to evaluate safety-related systems for flow division, and to evaluate the minimum flow bypass lines for safety-related pumps with respect to damage resulting from operations and testing in the minimum flow mode.

Results:

All actions in response to the bulletin had been completed by the licensee prior to this inspection. All actions were verified to be satisfactory and the inspector informed the licensee during the Exit on August 31, 1990, that Bulletin 88-04 was closed for Farley Units 1 and 2.

The licensee provided excellent support during this inspection. Necessary calculations and other documentation had been collated and transported to the site for ready availability and corporate engineering and architect-engineering personnel were available on-site as necessary to expedite the inspection.

Knowledgeable responses to technical issues raised by the inspector were provided.

No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

S. Casey, Systems Performance Supervisor
J. Cheney, Operations Shift Foreman
*M. Coleman, Manager - Plant Modifications
*R. Hill, Assistant General Manager - Operations
*R. Mullins, Project Licensing Engineer - Nuclear Support
*J. Osterholtz, Manager - Operations
*M. Scinson, Assistant General Manager - Support
*J. Thomas, Manager - Maintenance
W. Van Landingham, Operations Unit Supervisor

Other licensee employees contacted during this inspection included engineers, technicians, operators and office personnel.

Other Organizations

J. Ehman, BPC Nuclear Engineer
J. Dudiak, Westinghouse Senior Pump Engineer
B. Magee, Westinghouse Senior Systems Engineer
D. O'Reilly, BPC Mechanical Engineer

NRC Resident Inspectors

G. Maxwell, Senior Resident Inspector
*M. Morgan, Resident Inspector

*Attended exit interview on August 31, 1990

Acronyms and initialisms used throughout this report are listed in the final paragraph.

2. TI 2515/105, IEB 88-04, Potential for Safety-Related Pump Loss

IEB 88-04 was issued May 5, 1988, due to the potential for damage of safety-related centrifugal pumps when operated in parallel at low flow. When one of the pumps is "stronger" than the other (i.e., has a higher developed head for the same flow) it may cause "dead heading" of the weaker pump; i.e., pump impeller operation without fluid flow. This can lead to pump damage due to cavitation and heat buildup.

The inspector examined the licensee's responses to IEB 88-04 dated July 8 and November 30, 1988; and March 23 and September 21, 1989, to determine whether actions taken were satisfactory. The July 8, 1988, letter identified the following safety-related pumps:

SYSTEM	PUMPS	MANUFACTURER
HHSI or CCP	1A, 1B, 1C	Pacific Pump
	2A, 2B, 2C	Pacific Pump
LHSI or RHR	1A, 1B	Ingersoll-Rand
	2A, 2B	Ingersoll-Rand
CS	1A, 1B	Goulds
	2A, 2B	Goulds
AFW		
MDAFW	1A, 1B	Ingersoll-Rand
	2A, 2B	Ingersoll-Rand
TDAFW	U1, U2	Ingersoll-Rand
CCW	1A, 1B, 1C	Pacific Pump
	2A, 2B, 2C	Pacific Pump
SW	1A thru E	Byron-Jackson
	2A thru E	Johnston Pump
DGFO (5 manual & 5 automatic)	1-2A,1B,1C,2B & 2C (manual)	Goulds
	1-2A,1B,1C,2B & 2C (auto)	Goulds
BAT	1A, 1B	Goulds
	2A, 2B	Crane Deming
SFPC	U1 1 & 2	Goulds
	U2 1 & 2	Goulds

The inspector reviewed additional documents as required to verify licensee commitments contained in their response.

Documents associated with latest pump vendor recommendations and A-E calculations for the pumps listed above included:

a. Westinghouse correspondence ALA 88-929, November 3, 1988, Westinghouse letter to Mr. J. D. Woodard regarding Auxiliary Pump Minimum Flow Evaluation for Farley Units 1 and 2 and calculations No. P-EC-158, Auxiliary Pump Minimum Flow Evaluation for ALA/APR Projects, Revision 0, and FSSE/SS ALA 1203, Farley Safeguards Pumps Operating Modes, Revision 0, which established minimum flows for thermal protection (thermal) and long term protection (mechanical minimum flow) in all postulated scenarios (including design basis accident conditions) anticipated during the lifetime of the RHR, HHSI, CS, and BAT pumps. The methodology involved was reviewed and approved by the pump vendors involved.

Verification of the acceptability of thermal flow (50 gpm) for the RHR pumps was complicated due to errors for the efficiency parameter in the associated pump-head curves. The inspector noted that the errors only affected the thermal flow calculations and that 50 gpm was reasonable in comparison with the lowest acceptable mechanical minimum flow (373 gpm) which had been calculated without use of pump-head curves. Validity of 50 gpm was also established through examination of pump-head curves for an identical pump at another facility. However, the licensee agreed that the errors in the present RHR pump-head curves would be corrected.

b. BPC correspondences V-4529 and AP-16514 and calculation No. 29.01, Farley Nuclear Power Plant, Units 1 and 2 Auxiliary Feedwater Pumps Minimum Flow Evaluation, Revision 0, together with vendor correspondence established adequacy of the original minimum flow orifices for the AFW pumps. The calculation established preclusion of pump-to-pump interaction. Vendor concurrence was verified that the present pump minimum flow rates of 100 gpm (TDAFW @ 3960 RPM) and 45 gpm (TDAFW @ 2000 RPM; i.e., a possible speed when all three AFWs are running during reactor trip recovery) was acceptable for intermittent flow conditions; i.e., pump operation at these flows is limited to 3 hours or less in a 24 hour time period. Standard Operating Procedure, (SOP) 22.0, Auxiliary Feedwater System, Revision 21, was modified to include proper operator caution regarding the TDAFW pump at low flow. The 50 gpm provided by MDAFW orifices was determined to be adequate for continuous low flow operation.

Other design drawings and test results were also reviewed to verify adequacy of miniflow bypass lines and orifices associated with the above pumps. Operation of CS pumps at minimum flows with pump-to-pump interaction is limited to 1 minute during surveillance tests per FNP-1/2-STP-16.6, Spray and Phase B Actuation Test, Revision 9. HHSI miniflow orifices limit flow to 60 gpm and preclude pump-to-pump interaction since they provide almost all the greater than 2000 pound pressure drop through the miniflow lines. RHR pump-to-pump interaction is precluded through use of independent minimum flow lines and the CVCS Boric Acid System Operations procedure (SOP 2.6, Chemical and Volume Control System Boric Acid System, Revision 15), prohibits starting and operating both BAT pumps through the same miniflow line. CCW bypass miniflow lines are no longer used since CCW pumps are either secured or operated at full flow (including during surveillance tests per FNP-STP-1/2- 23.1 - 23.3, Component Cooling Water Pump (A-C) Quarterly Inservice Test, Revisions 9, 8 and 9). SW miniflow capacity is assured through provision of three bypass lines from the common header for the 5 SW pumps. Each bypass line has a 130 psig relief valve. SOP 24, Service Water System, Revision 29, requires verification of relief valve lift at proper setpoint as well as SW pump operation which precludes pump-to-pump interaction. DGFO pumps have no miniflow lines but are prevented from parallel operation by SOP 42, Diesel Generator Fuel Oil Storage and Transfer System,

Revision 14. Operation of more than one SFPC pump at a time is prohibited by SOP 54, Spent Fuel Pit Cooling and Purification System, Revision 11, which also requires that the inservice pump be operated near its best hydraulic efficiency (54 psid across the pump).

Historical documents reviewed to establish confidence that no damage to the above pumps has occurred due to hydraulic instability or inadequate minimum flow bypass line capacity included; 1988, 1989, and 1990 LERs (both units), summaries of MWOs written against the above pumps from installation to date, and summaries of ASME, Section XI, quarterly pump tests from 1988 to date. Details of all cases of impeller replacement or repair (10 occurrences for the above pumps) were examined and no damage associated with hydraulic instability was identified.

After examination of the above documentation and field verification the inspector concluded that licensee actions in response to IEB 88-04 were satisfactory.

3. Exit Interview

The inspection scope and findings were summarized on August 31, 1990, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. The inspector informed the licensee that bulletin 88-04 was closed for Farley Units 1 and 2. No dissenting comments were received from the licensee. Proprietary information was reviewed in the course of this inspection, but is not included in this report.

4. Acronyms and Initialisms Used in This Report

A-E	Architect-Engineer
AFW	Auxiliary Feedwater System
ASME	American Society of Mechanical Engineers
BAT	Boric Acid Transfer System
CCP	Centrifugal Charging Pump
CCW	Component Cooling Water System
CS	Containment Spray System
DGFO	Diesel Generator Fuel Oil Transfer System
gpm	gallons per minute
HHSI	High Head Safety Injection System
IEB	Inspection and Enforcement Bulletin
LER	Licensee Event Report
LHSI	Low Head Safety Injection System
MWO	Maintenance Work Order
MDAFW	Motor Driven Auxiliary Feedwater System
RHR	Residual Heat Removal System
SFPC	Spent Fuel Pool Cooling
SOP	Standard Operating Procedure
SW	Service Water System
TDAFW	Turbine Driven Auxiliary Feedwater System