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AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM AT THE ST. LUCIE NUCLEAR STATION, UNIT 2

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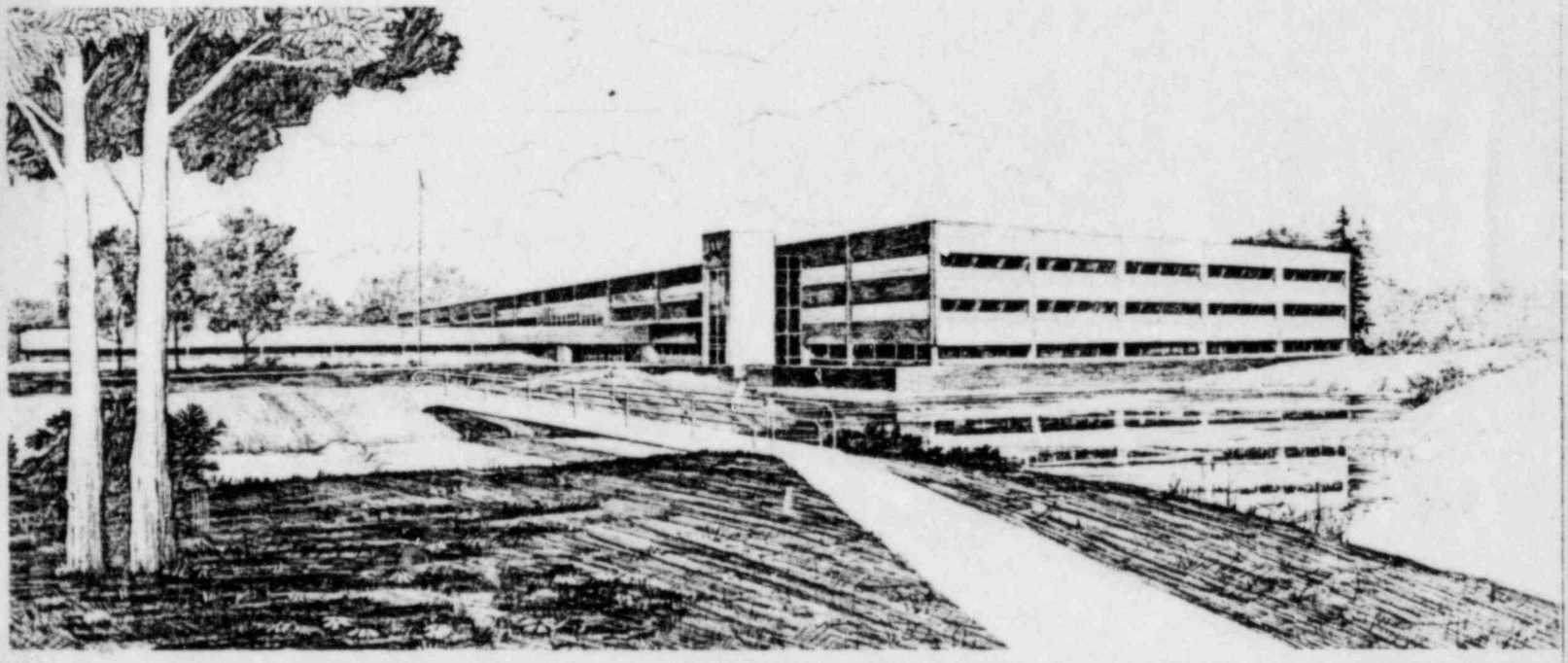
Operated by the U.S. Department of Energy



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INTERIM REPORT

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM AT THE ST. LUCIE NUCLEAR STATION, UNIT 2

DOCKET NO. 50-389

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Engineering Analysis Division

August 1982

ABSTRACT

The St. Lucie Nuclear Station, Unit 2 was audited to determine the adequacy of their pump and valve operability assurance program. Results of the audit are summarized in this report.

FOREWORD

This report is supplied as part of the "Equipment Qualification Case Reviews" project that is being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Engineering, Equipment Qualification Branch by EG&G Idaho, Inc., Engineering Analysis Division, Reliability and Statistics Branch.

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SUMMARY

The pump and valve operability assurance review team (PVORT) comprised of two EG&G personnel and two members of the Nuclear Regulatory Commission (NRC) staff conducted an on-site audit of the St. Lucie Unit 2 Pump and Valve Operability Assurance Program during the week of May 9, 1982. Eleven active pumps and valves that perform a safety function were selected for review and evaluation. The components were categorized as either nuclear steam supply system (NSSS) or balance of plant (BOP) items based upon which organization was responsible for the purchase and installation of the component. Combustion Engineering is the NSSS while Ebasco, an architectural engineering firm, is responsible for the BOP components.

The process used to evaluate the plant's overall Pump and Valve Operability Assurance Program includes (a) familiarization with the component and the system in which it is installed, (b) understanding the component's normal and safety function (c) a visual inspection of the installed component, and (d) a review of those documents relating to the operability of the component.

The results of this evaluation process were two-fold. Deficiencies or areas of concern were identified for some of the eleven components. These are specific to the component and are documented in the report. Of greater importance is that plant specific areas of concern were identified. It is recommended that the four plant specific concerns identified and listed below be addressed.

1. The licensee does not consider check valves as active components.

2. The licensee has not included all active safety-related valves in his pre-operational testing program.

3. The licensee does not have a complete and verified preventative maintenance program.

4. The licensee's central files may not contain all the required hydrostatic and leak rate test documents.

CONTENTS

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM AT THE ST. LUCIE NUCLEAR STATION, UNIT 2

1.0 INTRODUCTION

During the period May 11-14, 1982, a Pump and Valve Operability Assurance Review Team (PVORT) comprised of representatives of the Reliability and Statistics Branch of EG&G Idaho, Inc., and the Nuclear Regulatory Commission staff conducted an audit at the St. Lucie Nuclear Station, Unit 2 to determine the adequacy of the licensee's Pump and Valve Operability Assurance Program. The work effort consisted of (1) selecting a representative sampling of pumps and valves that perform a safety function, (2) identifying the precise safety function that each selected component must perform, (3) visually inspecting the installed configuration of the selected components and their supports, and (4) auditing the qualification documentation for the selected components to determine the extent to which their overall operability assurance program conformed to the criteria in Standard Review Plan (SRP) Section 3.10, (NUREG-0800).

Details and findings based on the evaluation of the eleven components selected for the audit are presented in Section 2.0. Qualification deficiencies (i.e., open items) for individual components are provided in Table 1. Section 3.0 presents additional concerns resulting from the audit process and recommendations as to how these concerns should be addressed.

2.0 EVALUATION OF SELECTED ITEMS

2.1 Nuclear Steam Supply System (NSSS) Items

Item: Bingham-Willamette Co., High Pressure Safety Injection Pump 2B
Model: 3 x 4 x 9 CP 7 Stage
ID: HPSI Pump 2B

This pump is located in the reactor auxiliary building at the 10 ft. elevation. It is a seven stage horizontal centrifugal pump driven by a

4000 VAC, 400 H.P. General Electric motor. The safety function of the pump is to start on a safety injection actuation signal (SIAS) and inject borated water into the reactor coolant system in the event of a small break. Review of the documentation package concerning the operability of this pump assembly (i.e., the pump and prime mover including any functional accessories) identified one minor concern. The pump and valve operability assurance review form that the licensee filled out contained an error in the serial number of the prime mover. This error was corrected during the audit.

While on the plant walk down portion of the review for this pump a safety hazard was pointed out to the licensee; the shaft coupling cover was not secured. The licensee acknowledged the hazard and agreed to secure the cover upon completion of coupling adjustments.

Item: Jamesbury Corp., Shutdown Cooling Control Valve
Model: 8966-DA-MOD.B
ID: FCV-3301

This valve is located in the reactor auxiliary building at the 10 ft. elevation. It is a 10 in. butterfly valve with a Limitorque SMB-000-HIBC variable speed DC motor actuator. The safety function of this valve is to maintain a constant shutdown cooling (SDC) flow to the reactor core in the SDC mode of the low pressure safety injection system. The documentation package concerning the operability of this valve assembly was not complete. The hydrostatic and leakage tests were not available for review, nor was any documentation available to account for flow induced vibration over the life of the valve with emphasis on pin loads. The licensee was asked to provide the hydrostatic and leakage test reports as well as a flow vibration load analysis for the valve.

Item: Fisher Controls, Injection Header Isolation Valve
Model: 667-DBQ Size 40 Actuator
ID: HCV-3648

This valve is located in the reactor containment building at the 45 ft. elevation. It is a one inch electro-pneumatic globe valve. The

safety function of the valve is to close on a safety injection actuation signal (SIAS) to isolate the 2B2 injection header check valve leakage line. Several concerns were identified during the review of this item. These concerns and their status are listed below.

1. The serial number on the PVORT review form did not match that of the valve name plate data. The form was corrected during the audit.

2. Concerns about closure against full ΔP were resolved after learning that the valve had been closed at full ΔP during a pre-operational test.

3. A rigid conduit supplying electrical power to the valve actuator was pointed out to the seismic review team (SQRT) as a potential problem. The SQRT felt there were no concerns, however, involving possible interactions between the conduit and actuator.

4. As part of concerns involving maintenance procedures on the valve actuator air supply filters, the licensee was asked to supply confirmation that these filters are included in the plant's maintenance program. The licensee agreed to respond to this request at a later date.

Item: Westinghouse, SDC Heat Exchanger Isolation Valve
Model: 12000 GM84NCH27D
ID: V-3517

This valve is located in the reactor auxiliary building at the 10 ft. elevation. It is a 12 in. motor operated gate valve with a Limitorque SB-0 actuator. The safety function of this valve is to remain closed until the requirements are met for entering the shutdown cooling mode of operation. At that time the valve will open allowing flow through the SDC heat exchanger. No concerns were identified upon reviewing the documentation package concerning operability for this valve assembly. (Note: The valve identification tag was found unsecured during the in-plant inspection. The licensee secured the tag prior to completion of the audit.)

Item: Fisher Controls, BAMT Recirculation Isolation Valve
Model: G67-ES, Size 34 Actuator
ID; V-2650

This valve is located in the reactor auxiliary building at the 0.5 ft. elevation. It is a one inch pneumatically operated globe valve. The safety function of this valve is to close on a safety injection actuation signal (SIAS), stopping recirculation of the boric acid makeup tank (BAMT) so that the charging pump can take a suction on the BAMT. Two concerns were identified upon reviewing the documentation package for the valve assembly. Valve closure during full flow conditions was not documented nor was such a test planned as part of the licensee's pre-operation testing program. The licensee agreed to include this valve in a periodic safeguard test program and in fact tested the valve for closure under full flow prior to the completion of the audit. The second concern involved hydrostatic and leak-rate test data not being available in the documentation package. The licensee agreed to supply this data at a later date.

2.2 Balance of Plant (BOP) Items

Item: Rockwell, Main Steam Isolation Valve (MSIV)
Model: 32" x 32" x 34" Fig. 312 GTMMTY
ID: I-HCV-08-1B

This valve is in the open environment of the main steam trestle area at the 36 ft. elevation. It is an air-operated Y-type bi-directional balanced stop valve. The valve serves two safety functions; 1) to close on a containment isolation signal (CIS) in the event of a loss of coolant accident (LOCA) and 2) to close on a main steam isolation signal (MSIS) in the event of a main steam line break (MSLB). Review of documentation concerning the operability of the valve assembly identified one concern involving the closure of the valve under full flow conditions. No prototype or model testing for full flow conditions was identified at the audit. The licensee could not demonstrate closure during pre-operation tests because no large cross-connect steam piping exists between Units 1 and 2. (Even though the capability for testing the valve will exist during

power-ascention tests,[1] the licensee considers such a test to be a severe transient and would rather demonstrate closure in some other manner.) The licensee will attempt to locate documentation that will satisfy this concern.

Item: MKM/ACF Industries, Containment Spray Isolation Valve
Model: C-3 Saf-T-Seal
ID: I-FCV-07-1A

This valve is located in the reactor auxiliary building (penetration area) at the 28 ft. elevation. It is a 12 in. air-operated gate valve. The valves safety function is to open on a containment spray actuation signal (CSAS) allowing borated water to flow into the containment spray nozzle system. After conducting the in plant inspection and documentation review for this item, no concerns were identified involving the operability of this valve assembly.

Item: TRW Mission, Containment Spray Check Valve
Model: 15 CEF-W 92
ID: 2I-V-7172

This valve is located in the reactor auxiliary building (penetration area) at the 9 ft. elevation. It is a double plate center hinged spring loaded 24 in. check valve. The safety function of this valve is to open when a suction is taken on the containment sump, (i.e., when recirculation is started after a LOCA). The normal function of the valve is to keep safety system water from leaking into the containment sump. The containment sump is designed to always be dry until a LOCA occurs; therefore, the upstream side of the check valve is also dry. Although the documentation package provided with the valve seemed adequate, it was not clear how the licensee was going to do a pre-operational test of the safety function since no suction could be taken on the containment sump. The licensee agreed to drain the downstream side of the check valve and to have someone crawl into the piping to ensure that both plates of the valve will fully open. Confirmation of this action is to be supplied at a later date.

Item: Pacific, Auxiliary Feed Turbine Steam Inlet Isolation Valve
Model: 4" 650-7-WE(80)-E
ID: I-MV-08-12

This valve is located in the open environment of the main steam trestle area at the 29 ft. elevation. The valve is a 4 in. motor operated gate valve with a Limitorque SMB-000-5 actuator. The safety function of the valve is to open on an auxiliary feedwater actuation signal (AFAS) allowing steam flow to the auxiliary feed turbine. After reviewing the documentation for this valve, the only concern involved whether the valve would stroke against full differential pressure (ΔP). The licensee informed the PVORT that pre-operational testing at full ΔP had been done on this valve using steam from Unit 1.

Item: Ingersoll-Rand, Auxiliary Feedwater Pump (Motor-Driven)
Model: 2HMTA-10
ID: AFW PUMP--2A

This pump is located in the open environment of the main steam trestle area at the 20 ft. elevation. It is a horizontally split multi-stage diffusor guide vane pump driven by a 4000 VAC, 3 phase, 60 Hz General Electric motor. The safety function of the pump is to start on an auxiliary feedwater actuation signal (AFAS) and provide water to the steam generators. Two minor concerns surfaced during the review process, 1) a bearing oil tag was found attached to the seal water line and 2) the interface between pump and motor was not addressed in the dynamic model. These concerns were closed by having the tag changed to the proper line and discussing with Ebasco the magnitude of expected shaft deflection. In addition the coupling between the pump and motor is self aligning, thus accounting for any small alignment problems.

Item: Byron Jackson, Intake Cooling Water (IWC) Pump
Model: 37 KXL 1-Stg VCT
ID: ICW Pump 2A

This pump is located in the intake structure building at the 19 ft. elevation. It is a single-stage vertical pump (42.75 ft. x 3.5 ft.) driven

by a 4000 VAC 600 H.P. General Electric motor. There are three ICW pumps, normally two are running continuously and the third is in standby. The safety function is for a second pump to start on a safety injection actuation signal (SIAS) if only one pump is running or for all three pumps to start on SIAS during a loss of off-site power. These pumps supply cooling water to heat exchangers during both normal and post-accident conditions. One concern that surfaced during the plant walk down phase of the review involved a traveling screen used to filter the water entering the pumps. The traveling screen did not have an emergency power supply. The licensee justified this by showing that at the flow rates for the ICW pumps, the ΔP across the screen would not be high enough to hold debris against the screen. The review of documentation involving pump assembly operability identified no concern. The seismic review team, however, disagreed with the methodology involving displacement between the impeller and casing in a seismic report. The SQRT has requested additional data and the PVORT may have questions based upon the outcome of the SQRT review of that data. The fact that these pumps are now operational and have been for a considerable period of time, adds confidence as to the qualification status of these pumps.

Table 1 summarizes the qualification status of all the items that were audited. If the status is open, the licensee action required to satisfy the concerns for each item is presented.

3.0 CONCERNS AND RECOMMENDATIONS

Areas of concern resulting from the audit are as follows:

1. The licensee does not consider check valves to be "active" valves. The staff however, does not exclude check valves from the operability assurance program. The licensee should be asked to justify why all check valves in safety systems shold not be considered active valves.

2. Three of the eleven components audited were not included in the licensee pre-operational testing program. Based upon this

apparent lack of pre-operational testing, it is recommended that the licensee reevaluate his testing program to insure that it includes all pumps and valves that perform a safety function.

3. The licensee presented an overview of his Generation Equipment Management System (GEMS) which is a computer program to aid in the scheduling of preventative maintenance and testing for all components. The licensee should verify that all pumps and valves providing a safety function are included in the GEMS, as work in that area is on-going at the present time.

4. Two of the eleven items failed to have hydrostatic and leakage test documents available. Additional central file reviews should be conducted by the licensee that will verify the existence of these documents in a representative sample of pump and valve documentation packages. The results of this review should be reported to the staff.

4.0 REFERENCES

1. "Initial Test Programs for Water-Cooled Nuclear Power Plants," Regulatory Guide 1.68, August 1978, Revision 2, Appendix A, Section 5.u., Page 1.68-17.

Table 1. Summary of the Qualification Status of the Audit Items

Item (I.D.)	Qualification Status	Licensee Action Required	Date Received	Final Status
1. HPSI Pump 2B	Closed	None	--	--
2. SDC Control Valve (FCV-3301)	Open	Additional documentation required: 1. Hydrostatic test documents. 2. Leakage test documents. 3. Flow vibration load analysis.	6-17-82 (hydro)	
3. Injection Header Isolation Valve (HCV-3648)	Open	Licensee confirmation required: 1. Provide proof that this valves air supply filters are included in GEMS.		
4. SDC Heat Exchanger Isolation Valve (V-3517)	Closed	None	--	--
5. BAMT Recirculation Isolation Valve (V-2650)	Open	Additional documentation required: 1. Hydrostatic test documents. 2. Leakage test documents.	6-17-82 (hydro)	
6. Main Steam Isolation Valve (I-HCV-08-1B)	Open	Additional documentation required: 1. Document(s) to confirm closure during full flow conditions.		
7. Containment Spray Isolation Valve (I-FCV-07-1A)	Closed	None	--	--
8. Containment Spray Check Valve (2I-V-7172)	Open	Licensee confirmation required: 1. Provide proof that a pre-op test was conducted that assured the valve would open.		

Table 1. (continued)

Item (I.D.)	Qualification Status	Licensee Action Required	Date Received	Final Status
9. Auxiliary Feed Turbine Steam Inlet Isolation Valve (I-MV-08-12)	Closed	None	--	--
10. Auxiliary Feed Pump (Motor) (AFW Pump-2A)	Closed	None	--	--
11. Intake Cooling Water Pump (ICW Pump-2A)	Closed*	*Although the qualification of the pump assembly appears adequate, the PVORT is awaiting the results of a SQRT review of additional documentation and reserves the right to re-evaluate this component.		