UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

February 21, 1984

Docket 50-346

Mr. Richard P. Crouse
Vice President - Nuclear
Toledo Edison Company
Edison Plaza - Stop 712
300 Madison Avenue
Toledo, Ohio 43652

Dear Mr. Crouse:

The enclosed Safety Evaluation Report addresses TMI Task Action Plan NUREG-0737 Items II.E.1.1 for the Davis-Besse, Unit No. 1 auxiliary feedwater (AFW) system. By letter dated August 3, 1982, we provided a status report on our evaluation of Item II.E.1.1 for Davis-Besse. In that report, five open items were identified. The enclosed evaluation closes out the five open items. In three cases we have stated what is necessary from you to meet the staff positions. In summary we request the following:

(1) Proposed Technical Specifications which would require that all local manual valves in the auxiliary feedwater pumps suction and discharge lines are locked in the open position and that the locked open position of these valves would be verified on a monthly basis.

(2) That your letter dated June 15, 1983, (Serial No. 956) be supplemented with proposed Technical Specifications which would require a flow verification test of the AFW system to put water into the Steam Generators after each extended cold shutdown.

(3) Proposed Technical Specifications which would require that a dedicated individual who would be in communication with the Control Room to be stationed at the manual valves of the AFW system when conducting periodic tests of the AFW system which require local manual realignment of valves to conduct the periodic tests of the AFW system.

You may choose to appeal the above requirements to the Division of Licensing in NRR. The final decision of the NRC staff on appeal of licensing requirements will be made by the Director, NRR.

We request a response which will identify your proposed action regarding our request within 30 days from receipt of this letter.

8402280720 XA

The reporting and/or recordkeeping requirements of this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

John F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing

Toledo Edison Company

cc w/enclosure(s):

Mr. Donald H. Hauser, Esq.
The Cleveland Electric
Illuminating Company
P. O. Box 5000
Cleveland, Ohio 44101

Gerald Charnoff, Esq.
Shaw, Pittman, Potts
and Trowbridge
1800 M Street, N.W.
Washington, D. C. 20036

Paul M. Smart, Esq.
Fuller & Henry
300 Madison Avenue
P. O. Box 2088
Toledo, Ohio 43603

Mr. Robert B. Borsum
Babcock & Wilcox
Nuclear Power Generation Division
7910 Woodmont Avenue, Suite 220
Bethesda, Maryland 20814

President, Board of County
Commissioners of Ottawa County
Port Clinton, Ohio 43452

Attorney General
Department of Attorney General
30 East Broad Street
Columbus, Ohio 43215

Harold Kahn, Staff Scientist
Power Siting Commission
361 East Broad Street
Columbus, Ohio 43216

Mr. James G. Keppler, Regional Administrator
U. S. Nuclear Regulatory Commission, Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Mr. Robert F. Peters
Manager, Nuclear Licensing
Toledo Edison Company
Edison Plaza
300 Madison Avenue
Toledo, Ohio 43652

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
5503 N. State Route 2
Oak Harbor, Ohio 43449

Regional Radiation Representative
EPA Region V
230 South Dearborn Street
Chicago, Illinois 60604

Ohio Department of Health
ATTN: Radiological Health
Program Director
P. O. Box 118
Columbus, Ohio 43216

James W. Harris, Director (Addressee Only)
Division of Power Generation
Ohio Department of Industrial Relations
2323 West 5th Avenue
P. O. Box 825
Columbus, Ohio 43216

SAFETY EVALUATION REPORT

DAVIS-BESSE UNIT 1

IMPLEMENTATION OF RECOMMENDATIONS OF

AUXILIARY FEEDWATER SYSTEMS

I. INTRODUCTION AND BACKGROUND

The Three Mile Island Unit 2 (TMI-2) accident and subsequent investigations and studies highlighted the importance of the Auxiliary Feedwater System (AFWS) in the mitigation of severe transients and accidents. As part of our assessment of the TMI-2 accident and related implications for operating plants, we evaluated the AFW systems for all operating plants. Our evaluations for operating plants with Westinghouse and Combustion Engineering nuclear steam supply systems (NSSS) are contained in NUREG-0611 and NUREG-0635, respectively. These NUREGs also contain our recommendations for each plant and the concerns which led to each recommendation.

The objectives of the evaluation were to: (1) identify necessary changes in AFW system design or related procedures at the operating facilities in order to assure the continued safe operation of these plants, and

(2) to identify other system characteristics of the AFW system which, on a long term basis, may require system modifications. To accomplish these objectives we:

1. Reviewed plant specific AFW system designs in light of current regulatory requirements (SRP) and,

2. Assessed the relative reliability of the various AFW systems under various loss of feedwater transients (one of which was the initiating event of TMI-2) and other postulated failure conditions by determining the potential for AFW system failure due to common causes, single point vulnerabilities, and human error.

At our request, Babcock and Wilcox (B&W) performed reliability studies on operating plants with B&W NSSSs using failure rate data and fault tree methodology similar to that of NUREG-0611 and NUREG-0635. The resulting generic study for B&W plants (BAW-1584) and plant specific reports have been previously reviewed by the staff. Based on that review and the generic recommendations in NUREG-0611 and NUREG-0635, this Safety Evaluation Report

was prepared. The licensee revised the reliability study and submitted it for our review by letter dated December 31, 1981. The revised reliability study also addresses the question of power diversity for the Davis-Besse AFWS which was raised several times by the staff and is now under review.

We conclude that the implementation of the recommendations identified during this review, and listed below, will considerably and acceptably improve the reliability of the AFW system for Davis-Besse.

A. Short Term Recommendations

1. Recommendation GS-1 - "The licensee should propose modifications to the Technical Specifications to limit the time that one AFW system pump and its associated flow train and essential instrumentation can be inoperable. The outage time limit and subsequent action time should be as required in current Standard Technical Specifications; i.e., 72 hours and 12 hours, respectively."

The existing Davis-Besse Technical Specifications require an inoperable auxiliary feedwater pump to be restored within 72 hours or the reactor must be in a hot shutdown condition within an additional 12 hours. Therefore, the Davis-Besse Technical Specifications are acceptable with respect to this recommendation.

2. Recommendation GS-2 - "The licensee should lock open single valves or multiple valves in series in the AFW system pump suction piping and lock open other single valves or multiple valves in series that could interrupt all AFW flow. Monthly inspections should be performed to verify that these valves are locked and in the open position. These inspections should be proposed for incorporation into the surveillance requirements of the Plant Technical Specifications. See Recommendation GL-2 for the longer-term resolution of this concern."

By letters dated May 22, 1981 and September 14, 1982, the licensee indicated that all local manual valves

in the auxiliary feedwater pumps suction and discharge lines are locked in the open position in accordance with the existing administrative procedure. Also, an existing procedure verifies on a monthly basis that these valves are in their correct position. We will require that the licensee propose Technical Specifications to incorporate these surveillance requirements. All other valves open automatically upon receipt of an initiation signal. We find the Davis-Besse auxiliary feedwater system acceptable, pending submittal of an acceptable Technical Specification for valve position surveillance, with respect to this recommendation.

3. Recommendation GS-3 - "The licensee has stated that it throttles AFW system flow to avoid water hammer. The licensee should reexamine the practice of throttling AFW system flow to avoid water hammer.

The licensee should verify that the AFW system will supply on demand sufficient initial flow to the necessary steam generators to assure adequate decay heat removal following loss of main feedwater flow and a reactor trip from 100% power. In cases where

this reevaluation results in an increase in initial AFW system flow, the licensee should provide sufficient information to demonstrate that the required initial AFW system flow will not result in plant damage due to water hammer."

The licensee stated that while the auxiliary feedwater (AFW) is not throttled to avoid water hammer, damage to the auxiliary feedwater header in both steam generators has been experienced. A licensee submittal dated April 30, 1982, transmitted a Licensee Event Report recording this damage. The damage was due to rapid condensation induced high differential pressure. The internal header was abandoned in place and a new external header was installed. (refer to the staff's Safety Evaluation Report dated August 20, 1982, for additional details and the staff's conclusion). A waterhammer test was subsequently performed in accordance with the Standard Review Plan Branch Technical Position ASB 1-2 and no waterhammer was detected.

Thus, we find the Davis-Besse auxiliary feedwater system acceptable with respect to this recommendation.

4. Recommendation GS-4 - "Emergency procedures for transferring to alternate sources of AFW supply should be available to the plant operators. These procedures should include criteria to inform the operators when, and in what order, the transfer to alternate water sources should take place. The following cases should be covered by the procedures:

   (1) The case in which the primary water supply is not initially available. The procedures for this case should include any operator actions required to protect the AFW system pumps against self-damage before water flow is initiated.

   (2) The case in which the primary water supply is being depleted. The procedure for this case should provide for transfer to the alternate water sources prior to draining of the primary water supply."

In NUREG-0645, the staff acknowledges that Davis-Besse has an automatic system to transfer the suction of the AFW pumps to an alternate water supply. Furthermore, Davis-Besse has an operator procedure to

manually transfer to the alternate water source should the automatic system fail to transfer to the alternate water source. In addition, a suction pressure switch set for 1 psig will automatically isolate the AFW turbine steam inlet lines, stopping the pump, and thereby preventing any pump performance degradation. Thus a system failure which might cause the pumps to transfer to an alternate water source will not result in loss of both pumps due to cavitation.

Thus, we find the Davis-Besse design for automatic transfer of the AFW suction to be acceptable with respect to this recommendation.

5. Recommendation GS-5 - "The as-built plant should be capable of providing the required AFW flow for at least two hours from one AFW pump train, independent of any AC power source. If manual AFW system initiation or flow control is required following a complete loss of AC power, emergency procedures should be established for manually initiating and controlling the system under these conditions. Since the water for cooling of the lube oil for the turbine-driven pump bearings may be dependent on AC power, design or procedural changes shall be made to eliminate this dependency as soon as practicable.

Until this is done, the emergency procedures should provide for an individual to be stationed at the turbine driven pump in the event of the loss of all AC power to monitor pump bearing and/or lube oil temperatures. If necessary, this operator would operate the turbine-driven pump in an on-off mode until AC power is restored. Adequate lighting powered by direct current (DC) power sources and communications at local stations should also be provided if manual initiation and control of the AFW system is needed. (See Recommendation GL-3 for the longer term resolution of this concern)."

For resolution of this recommendation, refer to GL-3.

6. Recommendation GS-6 - "The licensee should confirm flow path availability of an AFW system flow train that has been out of service to perform periodic testing or maintenance as follows:

(1) Procedures should be implemented to require an operator to determine that the AFW system

valves are properly aligned and a second operator to independently verify that the valves are properly aligned.

(2) The licensee should propose Technical Specifications to assure that, prior to plant startup following an extended cold shutdown, a flow test would be performed to verify the normal flow path from the primary AFW system water source to the steam generators. The flow test should be conducted with AFW system valves in their normal alignment."

By letter dated May 22, 1981, the licensee indicated that periodic testing of auxiliary feedwater systems is conducted monthly, the valves are returned to their normal operating position and the existing procedures require a second independent verification of proper valve alignment prior to returning the system to operability. We find the response to the first part of this recommendation acceptable.

The existing surveillance Technical Specification for the auxiliary feedwater system does not require that a flow test to be performed to verify that normal flow path from the primary auxiliary feedwater source to the steam generators. The licensee stated that operation of the AFWS would have an adverse impact on the water chemistry in the steam generators. By letter dated June 15, 1983, the licensee submitted a proposed Technical Specification change to verify the availability of the normal AFW flow path following any modification or repairs to the AFW system. The proposed Technical Specification change identifies two means to verify flow based on where the modification or repair was made in the AFW system. For those modifications or repairs made downstream of the test flow line, the AFW will pump water to the steam generator and the flow path availability will be verified by observing the change in steam generator water level. For those modifications or repairs made upstream of the test flow line, the AFW will pump water through the test flow line and the flow path availability

will be verified by observing the flow indicator in the test flow line. We will require that the proposed Technical Specification to be revised to include a flow verification test of the AFW system to put water into the steam generators after each extended cold shutdown, in accordance to this recommendation. We find the proposed Davis-Besse Technical Specification, acceptable, pending submittal of an acceptable revision of the Technical Specification, with respect to this recommendation.

7. Recommendation GS-7 - "The licensee should verify that the automatic start AFW system signals and associated circuitry are safety grade. If this cannot be verified, the AFW system automatic initiation system should be modified in the short-term to meet the functional requirements listed below. For the longer-term, the automatic initiation signals and circuits should be upgraded to meet safety-grade requirements, as indicated in Recommendation GL-5.

(1) The design should provide for the automatic initiation of the AFW system flow.

(2) The automatic initiation signals and circuits should be designed so that a single failure will not result in the loss of AFW system function.

(3) Testability of the initial signals and circuits shall be a feature of the design.

(4) The initial signals and circuits should be powered from the emergency buses.

(5) Manual capability to initiate the AFW system from the control room should be retained and should be implemented so that a single failure in the manual circuits will not result in the loss of system function.

(6) The AC motor driven pumps in the AFW system should be included in the automatic actuation (simultaneous and/or sequential) of the loads to the emergency buses.

(7) The automatic initiation signals and circuits shall be designed so that their failure will not result in the loss of manual capability to initiate the AFW system from the control room.

This recommendation is not applicable to the Davis-Besse design. Refer to Recommendation GL-1.

8. Recommendation GS-8 - "The licensee should install a system to automatically initiate AFW system flow. This system need not be safety-grade; however, in the short-term, it should meet the criteria listed below, which are similar to Item 2.1.7 of NUREG-0578. For the longer-term, the automatic initiation signals and circuits should be upgraded to meet safety-grade requirements, as indicated in Recommendation GL-1.

(1) The design should provide for the automatic initiation of the AFW system flow.

(2) The automatic initiation signals and circuits should be designed so that a single failure will not result in the loss of AFW system function.

(3) Testability of the initiating signals and circuits should be a feature of the design.

(4) The initiating signals and circuits should be powered from the emergency buses.

(5) Manual capability to initiate the AFW system from the control room should be implemented so that a single failure in the manual circuits will not result in the loss of system function.

(6) The AC motor-driven pumps and valves in the AFW system should be included in the automatic actuation (simultaneous and/or sequential) of the loads to the emergency buses.

(7) The automatic initiation signals and circuits should be designed so that their failure will not result in the loss of manual capability to initiate the AFW system from the control room."

This recommendation is not applicable to the Davis-Besse design. Refer to recommendation GL-1.

B. Additional Short-Term Recommendations

1. Recommendation - "The licensee should provide redundant level indication and low level alarms in the control room for the AFW system primary water supply, to allow the operator to anticipate the need to makeup water or transfer to an alternate water supply and prevent a low pump suction pressure condition from occurring. The low level alarm setpoint should allow at least 20 minutes for operator action, assuming that the largest capacity AFW pump is operating."

In the submittal dated December 15, 1982, the licensee stated that each of the two condensate storage tanks has a tank water level indicator as well as level switches for high and low water level alarms in the control room. The low level alarm setpoint is approximately 38' which corresponds to approximately 200,000 gallons. With maximum AFW flow conditions and both pumps taking suction from one tank, there is more than one hour's worth of water in the tank when the low level is alarmed. The two tanks are connected together by a 10" line. By letter dated August 5, 1983,

the licensee committed to having the two valves (CD163 and CD164) in the interconnecting line locked open. With these two valves open, the two tanks are hydraulically coupled together and therefore the instrumentation on one tank will be redundant to the instrumentation on the other tank.

Therefore, the Davis-Besse design is acceptable with respect to this recommendation.

2. Recommendation - "The licensee should perform a 72-hour endurance test on all AFW system pumps, if such a test or continuous period of operation has not been accomplished to date. Following the 72-hour pump run, the pumps should be shut down and cooled down and then restarted and run for one hour. Test acceptance criteria should include demonstrating that the pumps remain within design limits with respect to bearing/bearing oil temperatures and vibration and that pump room ambient conditions (temperature, humidity) do not exceed environmental qualification limits for safety-related equipment in the room."

The licensee provided the pump endurance test procedure and the results of the 72-hour tests which were

performed on both AFW pumps. The test results indicate that the bearing/bearing oil temperature and vibration design limits were not exceeded. The licensee performed the pump endurance tests prior to this recommendation being issued and did not monitor the pump room ambient conditions. These tests were performed prior to the II.E.1.1 recommendation being established. Further, the II.E.1.1 recommendation states that the test should be performed if they had not previously been performed. The licensee is not required to duplicate the tests to monitor the pump room ambient conditions. Therefore, the Davis-Besse design is acceptable with respect to this recommendation.

3. Recommendation - "The licensee should implement the following requirements as specified by Item 2.1.7b on page A-32 of NUREG-0578:

(1) Safety grade indication of AFW flow to each steam generator should be provided in the control room.

(2) The AFW flow instrument channels should be powered from the emergency buses consistent with satisfying the emergency power diversity requirements for the

AFW system set forth is Auxiliary Systems Branch Technical Position 10-1 of the Standard Review Plan, Section 10.4.9."

The licensee has provided the information and the Instrumentation and Control Systems Branch provided the evaluation of this recommendation, as part of TAP II.E.1.2, on September 30, 1982.

4. Recommendation - "Licensee with plants which require local manual realignment of valves to conduct periodic tests on an AFW system train which have only one remaining AFW train available for operation should proposed Technical Specifications to provide that a dedicated individual who is in communication with the control room be stationed at the manual valves. Upon instruction from the control room, this operator would align the valves in the AFW system from the test mode to its operational alignment."

The licensee stated in his submittal dated May 22, 1981, that the testing of an AFW pump requires manual operation of three valves, all of which are in series, in order to recirculate AFW flow to the condensate

storage tank. In lieu of a Technical Specification, the licensee proposed that the existing test procedure which requires the operator to be in direct communication with the control room during the test be accepted. If the AFW train being tested is required to feed water into the steam generator, the operator must close one of the three valves to close the flow path to the condensate storage tank and thereby direct the water to the steam generator. This is not acceptable. We will require that the licensee propose a Technical Specification in accordance with this recommendation.

Therefore, the Davis-Besse design is acceptable, pending submittal of an acceptable Technical Specification, with respect to this recommendation.

C. Long-Term Recommendations

1. Recommendation GL-1 - "For plants with a manual starting AFW system, the licensee should install a system to automatically initiate the AFW system flow. This system and associated automatic initiation signals should be designed and installed to meet safety grade requirements. Manual AFW

system start and control capability should be retained with manual start serving as backup to automatic AFW system initiation."

In NUREG-0316, dated December 1976, the staff concluded that the Davis-Besse safety-grade AFW automatic initiation system (1) starts the AFW system, (2) isolates a ruptured main feedwater or main steam system, and (3) automatically aligns the AFWS to the unaffected steam generator.

The Instrument and Control Systems Branch has provided an evaluation of the licensee's response to the recommendation on May 3, 1983, and found it acceptable.

2. Recommendation GL-2 - "Licensees with plant designs in which all (primary and alternate) water supplies to the AFW systems pass through valves in a single flow path should install redundant parallel flow paths (piping and valves).

Licensees with plant designs in which the primary AFW system water supply passes through valves in a single flow path, but the alternate AFW system water supplies

connect to the AFW system pump suction piping downstream of the above valve(s), should install redundant valves parallel to the above valve(s), or provide automatic opening of the valve(s) from the alternate water supply upon low pump suction pressure.

The licensee should propose Technical Specifications to incorporate appropriate periodic inspections to verify the valve positions into the surveillance requirements."

In NUREG-0645, the staff acknowledges that Davis-Besse has automatic transfer from the primary to the alternate water source on low AFW pump suction pressure.

Since the primary and alternate water supplies do not pass through the same single flow path with valves, the recommendation for a Technical Specification is not applicable.

Therefore, the Davis-Besse design is acceptable with respect to this recommendation.

3. Recommendation GL-3 - "At least one AFW system pump and its associated flow path and essential instrumentation should automatically initiate AFW system flow and be capable of being operated independently of any AC power source for at least two hours. Conversion of DC power to AC power is acceptable."

   By letter dated August 6, 1980, the licensee indicated that the modifications to make the turbine driven pump capable of being operated independently of any AC power source for at least two hours were complete. Therefore, we find the Davis-Besse design in conformance with the provisions of this recommendation.

4. Recommendation GL-4 - "Licensees having plants with unprotected normal AFW system water supplies should evaluate the design of their AFW systems to determine if automatic protection of the pumps is necessary following a seismic event or a tornado. The time available before pump damage, the alarms and indications available to the control room operator, and the time necessary for assessing the problem and taking action should be considered in determining whether operator action can be relied on to prevent

As described in the evaluation of GL-1, the Davis-Besse auxiliary feedwater system has safety grade automatic initiation signals and circuits. The final evaluation of this recommendation was provided by the Instrumentation and Control Systems Branch on May 3, 1983, as part of II.E.1.2.

6. Enclosure 2 to Our Letter of March 10, 1980 - In Enclosure 2 to our letter of March 10, 1980, we requested the licensee to provide certain information regarding the design basis for AFWS flow requirements. The licensee provided this information in their letter dated May 22, 1981, as an Enclosure. We have reviewed the information and conclude that the licensee's design basis for AFWS flow requirements is acceptable.

The following NRC personnel contributed to this Safety Evaluation Report: John Ridgely

Dated: February 21, 1984