October 30, 1985

DMB 016

Docket No. 50-346

DISTRIBUTION
Docket File
NRC PDR
L PDR
ORB#4 Rdg
HThompson
OELD
EJordan
BGrimes
JPartlow
GDick
ACRS-10
RIngram
ADe Agazio
CMcCracken
Gray file
EBrach
HOrnstein
WPaulson
GEdison

Mr. Joe Williams, Jr.
Vice President, Nuclear
Toledo Edison Company
Edison Plaza - Stop 712
300 Madison Avenue
Toledo, Ohio 43652

Dear Mr. Williams:

SUBJECT: EVALUATION OF ROOT CAUSE FINDINGS REPORTS

We have completed our reviews of nine Toledo Edison Company root cause findings and corrective action reports for plans 1A/1B/1C, 1D, 8, 9A/9B, 10, 12, 18, 26, and 27. Based on our reviews of these plans, we have concluded that Toledo Edison Company likely has identified the fundamental cause(s) of the equipment failure or malfunction being investigated.

The evaluations relating to our reviews of the above mentioned plans are included as attachments 1 through 8. Please note that we have identified additional testing, investigation, surveillance requirements or corrective actions in Attachments 2, 4, 6, and 8. Please review these evaluations and provide us your commitment to perform the additional actions identified. You should provide your response not later than November 4, 1985.

Three of remaining reports covering SFRCS, Nuclear Instrumentation, and Main Steam Header Pressure are still being reviewed by the staff. The results of these evaluations will be provided to you when completed.

Sincerely,

John F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing

Enclosure:
As Stated

cc w/enclosure:
See next page

| ORB#4:DL | ORB#4:DL | ORB#4:DL |
|---|---|---|
| ADe Agazio | CMcCracken | JStolz |
| 10/24/85 | 10/28/85 | 10/30/85 |

8511070128 851030
PDR ADOCK 05000346
S PDR

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

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

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
Suite 200, 7910 Woodmont Avenue
Bethesda, Maryland 20814

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

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

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

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

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

Mr. Harold Kohn, Staff Scientist
Power Siting Commission
361 East Broad Street
Columbus, Ohio 43216

President, Board of
Ottawa County
Port Clinton, Ohio 43452

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

OVERSPEED TRIPS OF THE AUXILIARY FEED PUMP TURBINES

TOLEDO EDISON PLANS NO. 1A/1B and 1C

We have reviewed the findings, corrective actions, and generic implications report entitled, "Overspeed Trips Of The Auxiliary Feed Pump Turbines on June 9, 1985 at Toledo Edison's Davis-Besse Nuclear Power Station" concerning the problems associated with an overspeed trip of the auxiliary feed pump turbines (AFPT). The AFPT is a steam driven turbine which drives the auxiliary feedwater pump. Both of the auxiliary feedwater pumps (AFP), including the turbine and overspeed trip mechanism (OTM), at Davis-Besse are identical except for the model of the governors.

Each AFPT is fed from its respective steam generator (SG), that is SG1 feeds AFPT 1 and SG2 feeds AFPT 2. In addition, there is a cross connection such that each SG can feed the redundant AFPT, i.e., SG1 can feed AFPT 2 and SG2 can feed AFPT 1. These cross connected lines are normally closed. During the June 9th event, a low SG1 level signal opened the steam line to AFPT 1. When the operator (five seconds later) tripped both channels on low SG pressure, the normal steam lines were isolated and the cross connected steam lines were opened. The licensee, by analysis, has determined that a large quantity of condensate could have been formed when the steam was admitted to the cold cross connect lines. The condensation in the steam lines formed a water slug at the AFPTs and could have caused the overspeed of the AFPTs. The licensee has proposed three different scenarios where this water slug could cause the AFPT to trip on overspeed. The first scenario is where the water slug in the governor valve causes the valve to open too far in an attempt to maintain turbine speed. When the water clears the valve, the valve admits too much steam and the AFPT trips on overspeed. The second scenario is where the water flashes as it enters the turbine and thereby accelerates the turbine due to the sudden expansion until it trips. The third scenario is similar to the first scenario except the water slows down the turbine and the governor valve opens to try to maintain speed. When the water clears the turbine, the governor

valve is open too far and the turbine trips on overspeed. In order to support this hypothesis, the licensee also calculated the quantity of condensate which could be formed in the normal lines used to power the AFPTs. A comparison of the quantity of condensate formed in the line from SG1 to AFPT 1 is almost as much as from SG2 to AFPT 1. The licensee could not explain why the AFPT 1 had never tripped on overspeed when fed from SG 1. In addition, the licensee has not determined how or why the condensate resulted in the overspeed tripping of the AFPTs. The identification of the root cause was done hypothetically and the licensee has not proposed to perform any verification tests.

The licensee has proposed maintaining all steam lines from the SGs to the AFPTs at full pressure and temperature up to the turbine inlet isolation valves, which are approximately 10 feet from the turbines. These turbine inlet isolation valves are to be replaced with pneumatically operated control valves. Thus, on an initiation signal, only the new valves will be required to change position. This valve lineup has been tested by the licensee, as indicated in a meeting on September 25, 1985. Each start of the AFPTs resulted in acceptable performance, i.e., no overspeed trips occurred.

Based on our review of the licensee's findings, corrective actions, and generic implications and the successful initiations of the AFPTs with hot steam lines, we believe that the licensee has identified the root causes of the operators inability to reset the AFPTs and that the licensee has proposed reasonable corrective actions. Therefore, we believe that the overspeed trip mechanism and associated linkage should be removed from the freeze list so that corrective action may begin.

Dated: October 30, 1985

The following NRR personnel contributed to this evaluation: John Ridgely

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

AFPT OVERSPEED TRIP THROTTLE VALVE PROBLEM

TOLEDO EDISON PLAN NO. 1D

We have reviewed the corrective actions and generic implementations report entitled "AFPT Overspeed Trip Throttle Valve Problem," Revision 1, concerning the problems associated with resetting the trip throttle (T&T) valve during the June 9, 1985, event at Davis-Besse. The T&T valve is a steam admission valve to the terry turbine which drives the AFW pump. Both of the AFW pumps, including the turbine, T&T valves, and overspeed trip mechanism (OTM), at Davis-Besse are identical.

The OTM consists of a spring loaded poppet in the turbine casing. The poppet is struck by spring loaded weights when the weights are pulled sufficiently away from the turbine shaft by centrifugal force. Once the poppet is struck, it moves away from the turbine shaft and releases the spring loaded trip linkage. The linkage releases the latch on the T&T valve, thereby allowing the spring in the T&T valve to close the valve. Resetting the AFPT overspeed trip involves manually moving the linkage, resetting the OTM, resetting the latch on the T&T valve and re-engaging the valve operator to the valve internals. If the linkage is not moved far enough, the OTM will not reset and if the T&T valve latches, the latch will only be due to friction between the parts of the linkage.

The problem, as identified in the licensee's report involves three areas: 1) improper procedures, 2) inadequate training and 3) insufficient trip status indication at the AFW pumps. Based on our review of the licensee's submittal, it appears that the licensee has adequately identified the root causes of the equipment operator's inability to reset the AFW pump after being tripped on overspeed. In general, the NUREG-1154 report entitled "Loss of Main and Auxiliary Feedwater Event at the Davis Besse Plant on June 9, 1985," indicates that the equipment operators performed their tasks associated with resetting the AFW pump trips as well as possible with the information and training available. It is our opinion that if any one of the above areas had not been deficient, the equipment operators probably would have been successful in resetting the AFW pumps.

The licensee has proposed the following corrective actions:

1. To modify the appropriate procedures to reflect the proper reset sequence for the OTM;

2. To modify the testing procedures to ensure that the T&T valve and OTM are reset after testing;

3. To provide operator training on the theory of operation for the OTM and T&T valve;

4. To provide operator "hands-on" training in the proper reset of the OTM and opening of the T&T valve with a minimum steam pressure of 800 psi;

5. To design and install local position indication of the OTMs and position indication of the T&T valves;

6. To paint the yoke of the T&T valve, the latch-up lever, trip yoke and connecting rod (for both AFPT's) yellow to distinquish this equipment as important in the operation of the overspeed trip. In addition, the manual trip level will be painted red; and

7. To provide enhanced communication for the equipment operators between both pump rooms and with the operators in the control room.

All of these corrective actions are to be completed prior to restart, except for Item 4 which will be complete before leaving Mode 3. The licensee identified additional planned actions in order to correct discrepancies noted during the course of their investigations. These actions include additional surveillance tests, preventive maintenance and replacement of some components. Some actions were proposed as one-time-only actions. These include performing NDE on the poppet leaf spring; verification of proper adjustment of the poppet; dimensional inspection of the poppet nut and head lever, connecting rod to trip hook lever and trip hook to latch-up lever mating

surfaces. These items should be made part of the 18 month surveillance requirements as well as verification that the OTM hold down screws are properly tightened and that the trip hook crank is in perpendicular alignment between the connecting rod and the trip hook pivot shaft.

Based on our review of the licensee's submittal and increased 18 month surveillance requirements, we believe that the licensee has identified the root causes of the operators inability to reset the AFPTs and that the licensee has proposed reasonable corrective actions. Therefore, we believe that the overspeed trip mechanism and associated linkage should be removed from the freeze list so that corrective action may begin.

The following NRR personnel contributed to the preparation of this evaluation:
J. Ridgely

DAVIS-BESSE

EVALUATION OF LICENSEE"S REPORT RELATING TO

MAIN FEED PUMP TURBINE AND CONTROL FAILURE

TOLEDO EDISON PLAN NO. 8

We have reviewed the findings report entitled, "Main Feed Pump Turbine and Control System Failure" concerning the problems associated with an overspeed trip of the main feed pump turbine (MFPT) No. 1 which was the initiating failure of the June 9, 1985, event at Davis-Besse. The MFPT is a steam driven turbine which drives the feedwater pump. Both of the main feedwater pumps (MFP), including the turbine, speed control system and overspeed trip mechanism (OTM), at Davis-Besse are identical.

The MFPT speed is controlled by an electronic hydraulic control system consisting of the following subsystems:

1. Signal converter circuitry;
2. Speed pickup feedback circuitry;
3. Speed summation and valve lift reference circuitry; and
4. Operator/pilot valve position feedback and servo amplifier circuitry.

The signal converter circuitry accepts a speed setpoint signal and produces a reference signal which corresponds to the demanded feedwater flow requirement. The speed pickup feedback circuitry provides the signal which corresponds to the speed of the MFPT. This signal is determined by automatic selection of one of two redundant signals. Each signal is generated by a pickup which monitors the passing of a toothed wheel which is mounted on the shaft of the MFPT.

The reference speed signal and the actual MFPT speed are summed and compared by the speed summation and valve lift reference circuitry. This circuitry produces a speed error signal and a valve lift reference signal. This reference signal is summed with the valve position feedback signals from the pilot valve and the operating cylinder by the operator/pilot valve position feedback and servo amplifier circuitry which produces a valve position error

signal. This error signal drives the servo valve to change the position of the pilot valve and operating cylinder. Thus the steam admission valve opens or closes to develop a zero error signal and thereby maintain the turbine speed at its predetermined value.

The problem, as identified in the licensee's report is the result of the failure of the frequency to voltage converter in the speed summation circuitry. This failure, which resulted in a fixed output of 0.0 volts, has been attributed by the licensee to a failed open capacitor.

Based on our review of the licensee's findings report, we believe that the licensee has identified the root causes of the overspeed tripping of the MFPT. The licensee has concluded that the capacitor failure on the reference circuit board was a random failure of an electronic component. Corrective action indicated is to replace the reference board, recalibrate, and return the control system to operational condition.

The following NRR personnel contributed to this evaluation: John Ridgely.

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

TURBINE BYPASS VALVE, SP 13A2, ACTUATOR FAILURE

TOLEDO EDISON PLAN NO. 9A/9B

The turbine bypass valves are part of the turbine bypass system and are used to control the flow of steam entering the condenser from the bypass header. Their purpose is to minimize loss of condensate to the atmosphere by directing steam flow to the condenser. These valves themselves are not important-to-safety or safety-related in terms of fulfilling their function in the plant.

The safety-related or important-to-safety implications of this failure are as follows:

1. The valve disk and stem were separated prior to the incident for an unknown period of time. This indicates that planned maintenance and/or inspection was deficient. A water hammer occurred in the piping upstream of the valve and coupled with impacting of the loose disk on the valve stem served to crack the valve casing and further damage the valve. The valve was not operational prior to the event and the licensee's maintenance plan did not discover it.

2. The common drain/isolation valve was closed although it should have been open. This valve and its associated header serves the turbine bypass valves and is intended to drain condensate from the lines in order to help prevent a water hammer event. This indicates that the operating procedure or that implementation of the operating procedure was deficient for this system.

3. Steam traps are provided in the lines from the steam generators for the purpose of draining condensate from the lines in order to minimize a potential water hammer. The steam traps were blocked with debris and thus improperly maintained. This indicates that planned maintenance and/or inspection procedures were deficient for these items.

4. There are missing loose parts in the system. Their potential effects on safety-related or important-to-safety equipment or systems should be assessed in detail.

5. The other valves of this system were visually inspected. It would appear that NDE of the castings might be justified. The licensee should assess the necessity to inspect the system and components further. The question of whether catastrophic failure of these valves could affect safety-related or important-to-safety systems or equipment should be addressed in detail.

6. The cause of separation of the valve seat from the stem has not been identified and should be evaluated. This would have impact on the potential generation of loose parts. Further, such a failure might occur in safety-related equipment of similar design.

The following NRR personnel contributed to this evaluation: Owen Rothberg

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

PORV MALFUNCTION DURING THE EVENT OF JUNE 9, 1985

TOLEDO EDISON PLAN NO. 10

During the Davis-Besse loss of feedwater transient of June 9, 1985, the pressurizer power operated relief valve (PORV) opened to relieve pressure three (3) times. The third time the PORV opened, it did not reseat as it should have when power was automatically removed from the actuating solenoid at the low pressure setpoint. Upon closure of the block valve the pressure had dropped approximately 300 psi below this setpoint. When the block valve was subsequently reopened, the PORV was found closed.

The Davis-Besse PORV is a Crosby style HPV-SN pilot operated valve with a solenoid actuator. The solenoid moves to open the pilot valve when electrically energized and returns to close the pilot valve when electrical power is removed. The pilot valve, when open, provides a vent path to the main valve disk which is then opened by the inlet system pressure. The main valve disk should reseat once the pilot valve recloses to seal off this vent path which allows pressure to rebuild on the back side of the main disk.

The licensee conducted an investigation to determine the causes of the PORV failure. The PORV has been removed from the pressurizer, dismantled and inspected. The PORV vendor, Crosby,, also participated in the valve inspection and several abnormalities were found:

a) Three (3) of eight (8) inlet flange nuts were found loose.
b) The adjusting bolt locking nut in the pilot valve linkage was found loose and a cotter pin only was in place to operate the adjusting bolt.
c) There was minor steam cutting on the pilot seat and disk.
d) A brown substance, speculated by the licensee to be boric acid, was found on the valve body in the vicinity of the pilot valve.
e) A sliver of metal from the bellows housing flexitallic gasket and small gouge in the outside edge of the gasket surface was found.

There was foreign material in the pilot sensing tube which caused the pilot disk to leak during leak testing performed after the transient. The licensee indicates the material is a liquid lubricant and would not affect the ability of the valve to open and close.

The licensee has concluded that none of these abnormalities could have caused the failure on June 9, 1985. Several other failure modes have been hypothesized by the licensee, including:

a) differential thermal expansion between the main disk and the valve body due to non-uniform heating upon actuation. (Calculations by the licensee show that clearances are more than adequate to preclude this type of binding action.)
b) other mechanical malfunctions such as loose or misaligned internal parts.
c) broken solenoid coil linkage.
d) control system malfunction.

The licensee has determined that none of these failure modes is very probable, and has determined that a more probable failure mode is that of foreign material lodging in the pilot disk and seat.

The staff agrees that this could have been a probable cause of failure, especially considering the long period of time since the last PORV actuation during which foreign material could have collected. Prior to the June 9 event, the licensee had not stroked the PORV since September 1, 1982. The staff has determined that the valve is required to be stroked according to the plant inservice testing (IST) program for pumps and valves at each cold shutdown. Therefore, the licensee has not met the plant IST requirements for the PORV during the time interval since September 1, 1982. The long period of time without actuation of the PORV may have contributed to the degradation of the valve operability and the lack of knowledge thereof.

Before the next restart, the licensee proposes to stroke the valve eight (8) times at reduced pressure (nominally 700 psig) and three (3) times at full pressure (nominally 2155 psig) during the plant restart in order to ensure that the valve is operable. Additionally, the licensee has proposed to stroke test the PORV at each shutdown in order to ensure its reliability during future plant operation.

The licensee's recommitment to stroke test the PORV in accordance with the plant IST program requirements is acceptable to the staff. Further, the staff finds the licensee's proposed startup test procedure of stroking the PORV three (3) times acceptable for assuring initial operability. With routine periodic testing during cold shutdown, it is more likely that problems with opening or closing the PORV may be detected early, i.e., prior to a challenge of overpressure. As required by Section XI of the ASME Code, the PORV must be repaired and retested if the valve fails a test.

The licensee is also investigating whether an alternative PORV design would be more appropriate for the Davis-Besse plant. This could involve a future plant modification should such a change be deemed necessary. Any PORV design which has not already been qualified by full flow testing as required by NUREG 0737, Item II.D.1 must be so qualified. In addition, any changes to the plant PORV inlet and discharge piping configuration must also be analyzed as required by Item II.D.1.

Although the licensee has not been able to positively identify the cause of the PORV failure, the staff has concluded that the post event evaluation was thorough. This evaluation did identify a number of valve installation deficiencies, degradation mechanisms, and Inservice Testing deviations which together clearly are evidence of at least a pre-event lax attitude on the part of the licensee relative to PORV operability. We have concluded that the testing to be performed by the licensee, both during startup and inservice, complemented by the additional PORV investigative effort yet to be performed should provide increased assurance of PORV operability for the Davis-Besse plant.

This evaluation was prepared by G. Hammer.

DAVIS-BESSE

EVALUATION AND STAFF POSITION REGARDING OPERATORS

FOR VALVES AF-599, AF-608 AND MS-106, PLANS 12 AND 27

AND OTHER MOTOR OPERATED SAFETY RELATED VALVES

We have reviewed the information provided by the licensee regarding the failures of the referenced valves to perform their safety related function to open during the June 9, 1985 event. Valves AF-599 and AF-608 are required to open on demand against high differential pressure to admit auxiliary feedwater to the steam generators. Valve MS-106 is required to open against high differential pressure to admit steam to the steam driven Auxiliary feed pump turbine.

As described in Action Plans 12 and 27, the licensee has concluded that all three failures to open resulted from incorrectly adjusted operator torque switches. For corrective action the licensee has described a methodology to be used for readjusting the torque switch settings on these and other safety related MOVs. Significant elements of this methodology include use of substantial portions of a procedure developed by Torrey Pines Technology, GA-CL6881 as revised in December, 1982 as well as the use of the MOVATS (Motor Operated Valve Assembly Testing System) testing technique.

Our review of the Torrey Pines procedure indicates that it does contain some useful information, but leads to the erroneous conclusion that torque switch adjustments arrived at solely following the procedure will assure valve function under all operating conditions. We find the procedure deficient in that it makes no allowance for degradation in valve performance over time.

Use of the MOVATS technique can be useful for confirming that valves are adjusted correctly, if the correct valve required stem thrust capabilities are first known.

From reviewing information provided to date by the licensee we have concluded that the licensee does not have an adequate justification that the torque switch settings derived using the Torrey Pines procedure (only based on new valve design dimensions, operating friction, etc., with no provision for degradation) can assure that the required open or closing forces will, in fact, be attained. Accordingly, in order to confirm the adequacy of the chosen adjustments prior to restart, we require that in-situ confirmatory testing be performed.

The licensee should establish theoretical torque and limit switch settings in accordance with its current analytical methodology. As a minimum, for the valves of the emergency core cooling systems and auxiliary feed systems, torque and limit switch settings are to be confirmed by in-situ testing.

An in-situ testing plan should be prepared by the licensee and submitted for staff review which will effectively demonstrate, using whatever conditions of pressure and flow rate are available in the plant for a particular valve, that the valve operator will function under both normal and transient and accident conditions of pressure and/or fluid velocity for which the applicable valve function is credited in accordance with FSAR analysis. Thermal overload bypass limit switches are to be operating during the above described tests.

The following NRR personnel contributed to this evaluation: Joel Page

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

STARTUP FEEDWATER VALVE, SP-7A, PROBLEM ANALYSIS,

CORRECTIVE ACTIONS AND GENERIC IMPLICATIONS

TOLEDO EDISON PLAN 18

We have reviewed the Davis-Besse licensee's report regarding the apparent failure of the startup feedwater valve, SP-7A, during the June 9, 1985 event at Davis-Besse. The report provides a step-by-step description of what appears to be a very thorough and methodical analysis and test program that was performed to determine the root-cause and possible generic implications of the indicated malfunctions of SP-7A and the SP-7A controls during the June 9, 1985 transient. This program was implemented in accordance with written procedures by licensee personnel supported by a representative of the valve manufacturer and a consultant on flow instrumentation. The reports state that the results of the tests and analysis indicate that: (1) the failed SFRCS channel 4 indication for SP-7A was due to a random or normal end-of-service-life indicating light bulb failure, and not to a system anomaly; (2) SP-7A was capable of providing a tight shutoff and responded in accordance with design to the June 9, 1985 transient; (3) the indicated flow through SP-7A was due to out of calibration and ambient temperature effects on the flow transmitter; and (4) there were no significant findings regarding generic implications. The reports do not include the raw event data and test data cited and the detailed design information necessary to enable the staff to independently verify the specific step-by-step results of the analysis and test program. However, based on our review of the methodology employed and on the reported results of the program, we conclude that there is reasonable assurance that the conclusions reached in regard to the root-cause and generic implications of the indicated malfunctions of SP-7A and its controls are valid, and that the report provides an acceptable basis for the corrective actions taken with respect to SP-7A and its controls.

The following NRR personnel contributed to this evaluation: Faust Rosa

DAVIS-BESSE

EVALUATION OF LICENSEE'S REPORT REGARDING

SPURIOUS TRANSFER OF AFW SUCTION TO SERVICE WATER

TOLEDO EDISON COMPANY PLAN NO. 26

We have reviewed the findings, corrective actions, and generic implications report entitled, "Service Water Transfer" concerning the spurious transfer of the auxiliary feedwater (AFW) pump No. 1 suction from the condensate storage tank to the service water system (SWS). The condensate storage tank is the non-safety related primary source of water for the AFW system. When the AFW system is needed and either the condensate storage tank is not available or has been emptied by the AFW system, a safety-related transfer system transfers the suction from the condensate storage tank to the SWS. The SWS is the safety-related secondary source of water. The transfer is initiated upon a low suction pressure signal and is designed to transfer the suction to the alternate source of water without damaging the AFW pumps.

During the June 9, 1985 event, the suction for AFW pump No. 1 transferred to the SWS while there was ample water in the condensate storage tank. AFW pump No. 2 did not experience any transfer. The licensee indicated that the pressure drop across the suction strainers in conjunction with the piping losses and load changes on pump No. 1 resulted in the low suction pressure. While the pressure drop across the strainers in the suction line of pump No. 2 and the effects of load changes would be similar to that experienced by pump No. 1, the piping losses would be less for pump No. 2 and thereby would not result in the transfer to the SWS. The licensee's proposed solution is to remove the strainers immediately ahead of each pump and to increase the mesh size of the strainer in the common suction line from the condensate storage tanks. In addition, the licensee has proposed decreasing the low suction pressure set-point and incorporating a time delay to reduce spurious transfers to the SWS.

In our SER input dated August 29, 1983, concerning the TMI Task Action Plan (TAP) Item II.E.1.1, we stated that the licensee met Recommendation GS-4 by having an automatic transfer of the AFW suction to the alternate source of water and by having an automatic isolation of the AFW turbine steam inlet lines

at a suction pressure of 1 psig. These two features provide protection of the pumps from cavitation. In response to the additional short-term recommendation No. 1, the licensee identified that the low level alarm setpoint on the condensate storage tank corresponds to approximately 200,000 gallons of water in the tank which is more than 1 hour's worth of water.

Because of the automatic transfer of the AFW pump No. 1 suction on June 9th, it is not clear whether the required technically specified volume in the condensate storage tanks could actually be pumped by the AFWS. With the reduced transfer setpoint, it is not clear that the pumps will be adequately protected from cavitation. The licensee has not proposed any testing to verify 1) the ability to pump the contents of the condensate storage tank into the steam generators or 2) the ability of the new transfer setpoint to provide adequate protection against cavitation for the AFW pumps. Therefore, the licensee should perform the aforementioned verification tests or propose modifications to the technical specifications which identify that a train of the AFWS is INOPERABLE whenever the related transfer system, transfer valves, or SWS is inoperable, in addition to the current requirements.

In the TAP Item II.E.1.1 review the staff considered the need to lock open single or multiple valves in series which could interrupt all flow from the water source(s) to the pumps and from the pumps to the steam generators. Additionally, where we realized that strainers were present we recommended their removal. Strainers are usually installed during construction and utilized during system pre-operational testing where there is the possibility of items entering the suction of the pumps. After pre-ops the strainers are normally removed. We recommend its removal thus eliminating a possible source of a common mode failure.

Based on our review of the licensee's findings, corrective actions, and generic implications report, we believe that the licensee has identified the root causes of the spurious transfer of the AFW pump No. 1 suction to the SWS. We do not believe that the licensee has proposed adequate corrective action and testing.

The following NRR personnel contributed to this evaluation: John Ridgely