FROM: J. C. Miller  
TO: R. C. Arnold  
SUBJECT: Preliminary Report on EMERGENCY FEED WATER SYSTEM

In accordance with your request, Ed O'Connor and I have undertaken to assess possible reasons why the emergency feed block valves (EF V-12A and 12B) may have been closed during the first few minutes of the incident at TMI-2 on March 28, 1979. Our assessment has not included any attempt to determine whether these valves were closed, but rather assuming that they were, why and for how long this condition may have existed.

Our assessment to date has focused on surveillance procedures which involve these valves and a review of the documentation of the surveillance during 1979.

The emergency feedwater system is subject to frequent surveillance of 1) valve alignment, 2) valve operation, and 3) pump test operation which requires operation and re-alignment of valves.

Surveillance requirements for in service inspection and testing must be performed in accordance with Section XI of ASME Boiler and Pressure Vessel Code and applicable addenda as required by 10CFR50.

Surveillance of the emergency feed system involving the EF V-12A and 12B valves has been accomplished twelve (12) times during 1979 prior to the date of the incident.

The surveillance test last performed prior to 0400 on March 28 which involved operation of EF V-12A and 12B valves was on March 26 from 1000 to 1245. Like all routine surveillance tests, this was scheduled to be performed by the RELIEF SHIFT during the day between 0700 to 1500. The surveillance testing coordinator delivers computer print-outs to the Control Room outlining each test to be performed during the week. After reviewing the schedule, the foreman of the RELIEF SHIFT arranges for his crew to do the testing in conjunction with crew manning the Control Room and plant operation.

The test March 26 was on motor driven emergency feed water pumps in accordance with procedure 2303-M27 A/B (see Attachment 1). On March 26 only M27B was performed on motor driven pumps. At the start of the test, copies of the sheets from the procedure giving the listing in sequence of steps to be performed were given to Auxiliary Operator and CRO. These serve both as step by step guide for testing and also as a check off list. Appendices A and B of the procedure, give valve alignments for testing the two pumps. It should be noted that only 6 of the 19 valves are unique to either the A or B pump systems; the other 13 valves are the same. The pumps are tested one at a time. Each test procedure requires closing both EF V-12A and EF V-12B which isolates both emergency feedlines to the steam generators. In the event of a reactor trip while the surveillance procedure is being executed, those lines would remain out of service until the CRO
opened EF V-12A and EF V-12-B from the Control Room.

In completing the test, the Auxiliary Operator brings his check off list back to Control Room and directs one of the CRO's to realign valves to normal operating alignment. This may be accomplished by the CRO assigned to RELIEF SHIFT or by CRO on the OPERATING SHIFT, or part by one and part by the other.

As is indicated by Attachment 2, this test is documented to have been successfully completed at 1245 on March 26. Neither this surveillance test nor any other test which involves operation of EF V-12A and V-12B was scheduled to be performed between completion of this test and 0400 on March 28.

As indicated above, the valve alignment required in step 6.2.2 in this procedure requires that both valves EF V-12A and V-12B be closed during the time the pump tests are run. Attachment 3 is a simplified piping diagram of emergency feed system, and from this diagram you will note that EF V-12A and V-12B are closed in order to produce pressure, when one pump is run, on the discharge side of non-return valves on the other two pumps not running. In this manner the tightness of the non-return valves can be checked as required in the procedure. The valve alignment in the procedure as originally prepared did not require V-12A and V-12B to be closed, because it was expected that EF V-11A and 11B, which are control valves and normally closed during normal plant operation, would be sufficiently tight to shut off flow to steam generators and thus provide for the pressure level required to test both the pumps and the non-return valves. However, valves V-11A and V-11B were not sufficiently tight, and Revision 4 was approved to include closing valves V-12A and V-12B in order to be able to accomplish the testing as structured in the procedure.

Our preliminary view at this time is that EF V-12A and 12B valves may have been closed for a period of up to forty-two (42) hours prior to the initiation of the incident, e.g., from about 1000 on March 26 when they were closed in accordance with valve alignment required in the surveillance procedure to 0400 on March 28. Based on existing documentation of the completion of the surveillance testing, valves EF V-12A and V-12B were correctly repositioned open. On the assumption both that the valves were correctly positioned open at the completion of the surveillance test about 1200 on March 26, and were shut at 0400 on March 28, they had to have been operated to closed position either from the Control Room or from the control station in the Auxiliary Building for shutdown outside the Control Room. Our view is that either of the latter happenings is unlikely.

In addition to our assessment of TMI-2 emergency feed system surveillance requirements, we have reviewed as well Procedures 1300-3F and 1300-3G A/B for surveillance testing of emergency feed system on TMI-1. TMI-1 is a simpler system. Attachment 4 shows a simplified diagram of the emergency feedwater system. The procedure for pump tests requires closing of only valves 10A and 10B for motor driven pumps and valves 2A and 2B for turbine driven pump. Thus at no time during the surveillance tests for TMI-1 are both emergency feed trains out of service simultaneously. Non-return valves 11A, 11B, and 13 are tested only during cold shutdown condition. TMI In-Service Inspection (ISI) group are working on revision to TMI-1 procedures that will require someone not a part of the test group to verify valve alignment following each surveillance test.

cc:  R. Long  
    E. O'Connor

Attachments (4)

J. G. Miller  
Executive Consultant
THREE MILE ISLAND NUCLEAR STATION
UNIT #2 SURVEILLANCE PROCEDURE 2303-M27A/B
MOTOR DRIVEN EMERGENCY FEEDPUMP
FUNCTIONAL TEST AND VALVE OPERABILITY TEST

NOTE: 2303-M27A includes pump and valve testing, 2303-M27B includes pump testing only.

1.0 PURPOSE

1.1 To insure compliance with Technical Specification 4.0.5 which references ASME Section XI for testing of pumps. ASME Section XI specifies test quantities to be measured and acceptable ranges for those quantities.

1.2 To insure compliance with TMI Unit #2 Technical Specifications, Section 4.0.5.a, which states:

Inservice testing of ASME Code Class 1, 2, and 3 pumps and valves shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda as required by 10 CFR50, Section 50.55a(g).

The above inservice testing will confirm the operation of the following ASME Code Class 3 valves:

EF-V1 A and B and EF-V27 A and B and EF-V2 (CLOSED)

2.0 APPLICABLE SURVEILLANCE FREQUENCY AND MODES

2.1 Surveillance Frequency --

31 days (H) for the pump tests (2303-M27B)

92 days (Q) for the valve tests (2303-M27A)

NOTE: Subsection 6.1 of this procedure includes both valve and pump testing; subsection 6.2 includes pump testing only. If 2303-M27A and 2303-M27B...
are both scheduled on the Weekly Checklist Master Schedule, perform subsection 6.1 only. If only 2303-M278 is scheduled perform subsection 6.2 only. All of the steps in 6.2 are included in 6.1.

2.2 Modes: 1 thru 4 - Testing required per ASME Section XI. 5 and 6 - Testing optional per ASME Section XI.

3.0 LIMITS AND PRECAUTIONS

3.1 When a reference value or set of values may have been affected by repair or routine servicing of the pump, a new reference value or set of values shall be determined, or the previous value reconfirmed by an in-service test run prior to or within 96 hours after return of the pump to normal service. Deviations between the previous and new set of reference values shall be identified and verification that the new values represent acceptable pump operation shall be placed in the Technical Specifications surveillance file for that pump.

3.2 An in-service test shall be run on each pump nominally each month during normal plant operation. It is recommended that this test frequency be maintained during cold shutdown periods where this can reasonably be accomplished, although this is not mandatory.

3.3 Pumps that are operated more frequently than every month need not be run or stopped for a special test provided the quantities specified were measured, observed, and analyzed.

3.4 All test data must be analyzed within 96 hours after test completion.

3.5 Bearing temperatures are only required to be measured once every year. When measurement of bearing temperature is not required,
each pump shall be run for at least five minutes under conditions as stable as the system permits. At the end of this time at least one measurement of each of the quantities specified shall be made and recorded.

3.6 The vibration probe must be placed in the same position each test to insure repeatable measurements.

3.7 Record identification of the instruments used on the Data Sheet.

3.8 Instruments used for measuring quantities shall not have a scale range exceeding four times the reference value.

3.9 If a valve is in an out of service system, it need not be exercised until immediately prior to return of the system to service.

3.10 After a valve or its control system has either been replaced, repaired, or has undergone maintenance that could affect its performance, and prior to the time it is returned to service, it shall be tested as necessary to demonstrate that the performance parameters which could be affected are within acceptable limits. Adjustment of stem packing; removal of the bonnet, stem assembly, or actuator; or disconnection of hydraulic or electrical lines are examples of maintenance that could affect valve performance parameters.

4.0 LOCATION OF SYSTEM

4.1 Emergency feedwater pumps are located in the Control Building Area, "elevation 290'5".

4.2 Controls for the emergency feedwater pumps are located in Control Room on Panel 4. Local controls are also available.

5.0 EQUIPMENT REQUIRED

5.1 IRD Vibration Analyzer, Model 306, or equivalent.

5.2 Eagle Eye Meter, Model 77C, ± 1.5% full scale, 0-50 inches of water or equivalent.

3.0
5.3 **Stopwatch** - required only if 2303-M27A is scheduled.

6.0 **PROCEDURE**

**NOTE:** The following procedure may be used for Motor Driven Emergency Feedpump 2A or 23. Those components designations in (parentheses) refer to the B system.

**NOTE:** Subsection 6.1 includes both valve and pump testing; subsection 6.2 includes pump testing only. If 2303-M27A and 2303-M27B are both scheduled on the Weekly Checklist Master Schedule, perform subsection 6.1 only. If only 2303-M27B is scheduled perform subsection 6.2 only. All of the steps in 6.2 are included in 6.1.

*Initial Each Step After Satisfactory Completion.*

6.1 Emergency Feed Pump (EF-P2A(B)) and valve test.

- **6.1.1** INSTALL Eagle Eye Meter or equivalent at CO-FE-7616 (7617).
- **6.1.2** PERFORM Appendix A (B) Valve Line up.
- **6.1.3** RECORD on Data Sheet A (B) the pump idle inlet pressure from CO-PI-2025 (2026).
- **6.1.4** INSURE Proper lube oil level on pump from bearing sight glasses and INITIAL Data Sheet.
- **6.1.5** From its local control switch, OPEN EF-V-27A(B) and time from when the open button is pressed until only the red open light is illuminated on the panel. Record time on Data Sheet A(B).
- **6.1.6** CLOSE EF-V27A(B).
6.1.7 START EF-P-2A (B) from Panel 4.

6.1.8 INSURE EF-V27A (B) automatically opens.

6.1.9 THROTTLE OPEN EF-V39 (EF-V40) until the flow rate as indicated by the differential pressure across CO-FE-7616 (7617) corresponds to the reference value. The reference value is designated on the Data Sheet. Calculate flow rate from the equation \( Q = 65.05 \sqrt{\Delta P} \) where \( \Delta P \) is the differential pressure across CO-FE-7616 (7617) in inches of water, and \( Q \) is in gpm.

6.1.10 Cooling water flow to floor drain indicates that check valves EF-V1A(B) opened as required. Record on Data Sheet A(B) if valves EF-V1A(B) opened as required.

6.1.11 With pump EF-P-2A(B) operating as required, verify that pump EF-P-2B(A) is not windmilling due to fluid backflow through EF-V1B(A). Record on Data Sheet B(A) that valves EF-V1B(A) closed as required.

6.1.12 With pump EF-P-2A or EF-P-2B operating as required, verify that pump EF-P-1 (steam driven EF pump) is not windmilling due to fluid backflow through EF-V2. Record on Data Sheet A that valve EF-V2 closed as required.

6.1.13 LET pump run five minutes or longer until system stabilizes.

NOTE: Perform the following two steps only the first time this test is run during each calendar year, since bearing temperature measurement is only required once each year.

5.0
6.1.14 ALLOW EF-P-2A (2B) to run until three successive bearing temperature measurements (as indicated by Computer Group 16, or Computer points 1653 and 1654 (1658 and 1659)) taken at 10 minute intervals, change by less than 3%.

6.1.15 RECORD on Data Sheet A (B) the bearing temperatures, and times taken. RECORD the final temperatures in the table.

6.1.16 RECORD the pump running inlet pressure from CO-PI-2025 (2026).


6.1.18 CALCULATE and RECORD flow rate on Data Sheet A (B) using the equation $Q = 66.05 \sqrt{\Delta P}$ where $\Delta P$ is the D/P across CO-FE-7616 (7617) in inches of water, and Q is in gpm.

6.1.19 MEASURE and RECORD the pump inboard bearing vibration in the horizontal and vertical plane perpendicular to the rotating shaft. INDICATE the higher of the two vibration amplitudes and designate whether in the horizontal (H) or vertical (V) plane. INSURE the probe is on the designated test points.

5.1.20 STOP EF-P-2A (B).

6.1.21 REMOVE Eagle Eye Meter.
6.1.22 Insure EF-V3A(B) is open, EF-V12A(B) is open, EF-V7A(B) is closed, and close EF-V39(EF-V40).

6.2 Emergency Feed Pump (EF-P2A(B)) Test.

6.2.1 INSTALL Eagle Eye Meter or equivalent at CO-FE-7616 (7617).

6.2.2 PERFORM Appendix A (B) Valve Line up.

6.2.3 RECORD on Data Sheet A (B) the pump idle inlet pressure from CO-PI-2025 (2026).

6.2.4 INSURE proper lube oil level on pump from bearing sight glasses and INITIAL Data Sheet.

6.2.5 START EF-P-2A (B) from Panel 4.

6.2.6 INSURE EF-V27A (B) automatically opens.

6.2.7 THROTTLE EF-V39 (EF-V40) until the flow rate as indicated by the differential pressure across CO-FE-7616 (7617) corresponds to the reference value. The reference value is designated on the Data Sheet. Calculate flow rate from the equation \[ Q = \frac{66.05 \sqrt{\Delta P}}{gpm} \] where \( \Delta P \) is the differential pressure across CO-FE-7616 (7617) in inches of water, and \( Q \) is in gpm.
LET pump run five minutes or longer until system stabilizes.

NOTE: Perform the following two steps only the first time this test is run during each calendar year, since bearing temperature measurement is only required once each year.

ALLOW EF-P-2A (2B) to run until three successive bearing temperature measurements (as indicated by Computer Group 16, or Computer points 1653 and 1654 (1658 and 1659)) taken at 10 minute intervals, change by less than 3%.

RECORD on Data Sheet A (B) the bearing temperatures, and times taken. RECORD the final temperatures in the table.

RECORD the pump running inlet pressure from CO-PI-2025 (2026).


CALCULATE and RECORD flow rate on Data Sheet A (B) from the equation $Q = 66.05 \sqrt{\Delta P}$ where $\Delta P$ is the differential pressure across CO-FE-7616 (7617) in inches of water, and $Q$ is in gpm.

MEASURE and RECORD the pump inboard bearing vibration in the horizontal and vertical plane perpendicular to the rotating shaft. INDICATE the higher of the two vibration amplitudes and designate whether in the horizontal (H) or vertical (V) plane. INSURE the probe is on the designated test points.

STOP EF-P-2A (B).
6.2.16 REMOVE Eagle Eye Meter.

6.2.17 Insure EF-V3A(B) is open, EF-V12A(B) is open, EF-V7A(B) is closed, and close EF-V39 (EF-V40).

7.0 ACCEPTANCE CRITERIA

7.1 If measured values fall within the Acceptable Range, Analysis portion of the data sheet shall be filled out and signed by the Shift Supervisor/Shift Foreman within 96 hours.

7.2 If deviations fall within the Alert Range, the frequency of testing shall be doubled until the cause of the deviation is determined and the condition corrected. Analysis portion of the data sheet shall be filled out and signed by the Lead Mechanical Engineer/ISI Coordinator within 96 hours.

7.3 If deviations fall within the Required Action Range, the pump shall be declared inoperative and not returned to service until the cause of the deviation has been determined and the condition corrected. Analysis portion of the data sheet shall be filled out and signed by the Lead Mechanical Engineer/ISI Coordinator.

NOTE: Correction can be replacement or repair or an analysis to demonstrate that the condition does not impair pump operability and that the pump will still fulfill its function. A new set of reference values shall be established after such analysis.

NOTE: Modes 1 thru 3 - Two motor driven emergency feedpumps OPERABLE per T.S. 3.7.1.2.
NOTE: If the acceptance criteria are not met, proceed with ACTION statement 3.7.1.2.

7.4 Each of the valves which has been tested to function, shall have been observed to function as required on the data sheet. If a valve fails to exhibit the required change of valve stem or disc position during the test, corrective action shall be initiated immediately. If the condition is not or can not be corrected within 24 hours, the valve shall be declared inoperative. When corrective action is required as a result of tests during cold shutdown, the condition shall be corrected before startup. A retest showing acceptable operation shall be run following any required corrective action before the valve is returned to service.

7.5 When valve testing has been performed, the Analysis portion of the data sheet shall be filled out by the Lead Mechanical Engineer/ISI Coordinator.
DATA SHEET A

Motor Driven Emergency Feedpump EF-P-2A Functional Test

1. Pump idle inlet pressure ______ psig
2. Pump running inlet pressure (6.1.16 or 6.2.11) ______ psig
3. Pump running discharge pressure (6.1.17 or 6.2.12) ______ psig
4. Calculate differential pressure (#3 - #2) ______ psig
5. Lube oil level (Initial if satisfactory) ______
6. Pump Inboard Bearing Vibration (mils) H ______
   V ______

<table>
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<tr>
<th>QUANTITY</th>
<th>MEASURED VALUE</th>
<th>ACCEPTABLE RANGE</th>
<th>ALERT RANGE</th>
<th>REQUIRED ACTION RANGE</th>
<th>REFERENCE VALUE</th>
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<tbody>
<tr>
<td>PUMP IDLE INLET PRESS. (PSIG)</td>
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*Measurements taken only during first test run each calendar year.
### DATA SHEET A (Cont'd)

**Bearing Temperatures**

**NOTE:** To be measured yearly.

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**NOTE:** Three consecutive measurements taken at 10 minute intervals must change by less than 3%. 

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12.0
<table>
<thead>
<tr>
<th>Valve No.</th>
<th>Stroke Time (sec)</th>
<th>Acceptance Criteria</th>
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</thead>
<tbody>
<tr>
<td>EF-V27A</td>
<td>OPEN in  ________</td>
<td>&lt;3 sec.</td>
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</tbody>
</table>

**Valve No.** | **Valve Function Requirement** | **Date/Initial**
---|---|---
EF-V1A      | (check valve) OPEN | 
EF-V1B      | (check valve) CLOSED | 
EF-V2       | (check valve) CLOSED | 

**PERFORMED BY:** ________________________ **DATE:** ________________ **TIME:** ________________

**APPROVED BY:** ________________________ **DATE:** ________________

**ANALYSIS:**

**Analysis by:** ________________________ **DATE:** ________________ **TIME:** ________________

Analysis performed within 96 hours?  Yes ___ No ___
DATA SHEET B
Motor Driven Emergency Feedpump EF-P-2B Functional Test

1. Pump idle inlet pressure ______ psig
2. Pump running inlet pressure (6.1.16 or 6.2.11) ______ psig
3. Pump running discharge pressure (6.1.17 or 6.2.12) ______ psig
4. Calculate differential pressure (e3 - e2) ______ psig
5. Lube oil level (Initial if satisfactory) ______
6. Pump Inboard Bearing Vibration (mils) H ______ V ______

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>MEASURED VALUE</th>
<th>ACCEPTABLE RANGE</th>
<th>ALERT RANGE</th>
<th>REQUIRED ACTION RANGE</th>
<th>REFERENCE VALUE</th>
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*Measurements taken only during first test run each calendar year.
**DATA SHEET B (Cont'd)**

**Bearing Temperatures**

**NOTE:** To be measured yearly.

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**NOTE:** Three consecutive measurements taken at 10 minute intervals must change by less than 3%. 

15.0
### DATA SHEET 8 (Cont'd)

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#### Valve No. Stroke Time (sec.) Acceptance Criteria

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<th>Valve No.</th>
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<td>EF-V27B</td>
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#### Valve No. Valve Function Requirement Date/Initial

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<th>Valve No.</th>
<th>Valve Function</th>
<th>Requirement</th>
<th>Date/Initial</th>
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<td>(check valve)</td>
<td>OPEN</td>
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<td>EF-V1 A</td>
<td>(check valve)</td>
<td>CLOSED</td>
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<th>DATE:</th>
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#### ANALYSIS:

Analysis by: __________________ DATE: __________ TIME: __________

Analysis performed within 96 hours? Yes No
### APPENDIX A

Motor Driven Emergency Feedpump, EF-P-2A Recirculation Valve Line-Up

<table>
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<th>Valve</th>
<th>Description</th>
<th>Position</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-V85</td>
<td>Iso Valve on Header from Cond. Pumps</td>
<td>OP</td>
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<tr>
<td>CO-V82A</td>
<td>Iso Valve from Cond. Storage Tanks</td>
<td>OP</td>
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</tr>
<tr>
<td>CO-V83A</td>
<td>Suction to EF-P-2A</td>
<td>L.O.</td>
<td></td>
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<td>EF-V7A</td>
<td>EF-P-2A Recirc to Cond.</td>
<td>OP</td>
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<td>EF-V3A</td>
<td>EF-P-2A Recirc. to CO-T-1A</td>
<td>CL</td>
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<td>EF-V9</td>
<td>CO-T-1A isolation valve</td>
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<td>CO-V33A</td>
<td>EF Suction from CO-T-1A</td>
<td>OP</td>
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<td>CO-V98B</td>
<td>EF Suction From CO-T-1B</td>
<td>OP</td>
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<td>CO-V87</td>
<td>EF Pumps Suct Hdr Block</td>
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<td>Emerg. F.W. to RC-H-1A</td>
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<td>EF-V12A</td>
<td>Emerg. F.W. to RC-H-1A</td>
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<td>EF-V11A Bypass</td>
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<tr>
<td>EF-V33A</td>
<td>EF-V12A Bypass</td>
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<td>EF-V29A</td>
<td>EF-P-2A Cooling Water Inlet</td>
<td>OP</td>
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<td>EF-V31A</td>
<td>Bearing cooling water outlet</td>
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<td>EF-V11B</td>
<td>Emerg. F.W. to RC-H-1B</td>
<td>CL</td>
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<td>EF-V12B</td>
<td>Emerg. F.W. to RC-H-1B</td>
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<td>EF-V32B</td>
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<td>EF-V12B Bypass</td>
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## APPENDIX B

**Motor Driven Emergency Feedpump, EF-P-2B Recirculation Valve Line-Up**

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<tr>
<td>CO-V85</td>
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<td>CO-V82B</td>
<td>Iso Valve from Cond. Storage Tanks</td>
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<td>CO-V9B</td>
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<td>CO-V87</td>
<td>EF Pumps SuctHdr Block</td>
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<td>EF-V29B</td>
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<td>EF-V31B</td>
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PROCEDURE NO: 2303-M78
TECH/SPEC REF: 4.0,5
DEPT REF: OPERATIONS
ASME SECTION XI
TASK NO: 2303-M78
EF-2A/F PUMP TESTING

WORK ORDER NO.: 01600326
ACCOUNT NO.: 520.1
GC CODE: 20
COMPONENT NO.: T-1-2303-M 27-A
COMPONENT DESC: STANDARD TECH SPEC ITEM
COMP LOCATION: BOG LVL GRID

SPECIAL COMMENT:
PLANT CONDITION: 1-1=1-0=6-0-1
FREQUENCY: QUALITY CONTROL 1
SPECIFIC DAY:
CONTRACTOR: O INTERFERENCE: O
PRIORITY: 1 COMPONENT STATUS: 1

RESULT (51):
DATE: 03/18/79
CHECKED: 06/17/79
PERFORMED: 03/21/79

ACTUAL HOURS: 00:00.01
ACTION TAPE CODE: L L L I
REASON NOT PERFORMED: L L L I
ABNORMAL OCC DEPT: L L L L

PERFORMED BY EMPLOYEE NUMBER: 10621401
APPROVED BY EMPLOYEE NUMBER: 0573032 I
WITNESSED BY EMPLOYEE NUMBER: 0573032 I

CORRECTIVE MAINTENANCE JOB TICKET NUMBER: L L L L L

ASSISTING DEPARTMENTS:

ASSISTING DEPARTMENTS:

403A (1) DUPLICATE AS ABOVE (S-38) 402A (1) DUPLICATE AS ABOVE (S-38)

RESULTS DESCRIPTION

ASSISTING DEPARTMENTS:

ASSISTING DEPARTMENTS:

POOR ORIGINAL
**SURVEILLANCE PERFORMANCE FORM**

**DATE** 02/24/79

**MET-TIM1 UNIT 2**

**EARLY DATE** 03-07-79

**LATE DATE** 04-29-79

---

**PROCEDURE NO** 2303-M2/A

**TECH/SPEC REF** 4-V.S

**DEPT RESP - OPERATIONS**

**ASME SECTION XI**

**TASK NO** 2303#27A

**EF-P2A/B PUMP & VALVE TESTING**

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**MURK ORDER NO** 036000320

**ACCOUNT NO** 520-1

**GC CODE** 2-V

**COMPONENT NO** TN-2303-M 27-A

**COMPONENT DESC** STANDARD TECH SPEC ITEM

**COMP LOCATION** BOG _ LVL _ I

**SPECIAL COMMENT**

**PLANT CONDITION** 1-1-1-0-0-0-1

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**ASSIST DEPT**

**FREQUENCY** 0

**QUALITY CONTROL** I

**SPECIFIC DAY**

**INTERFERENCE** 0

**CONTRACTOR** 0

**PRIORITY** 1

**COMPONENT STATUS** 1

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**COMPLETE THIS SECTION**

---

**RESULTS**

**DATE PERFORMED** 03/12/79

**MONTH** 03

**DAY** 12

**YEAR** 79

---

**CHECK**

**ONE OF** 2 EXCEPTIONS

---

**3 DEFIENCIES**

---

**4 BOTH E'S AND D'S**

---

**PERFORMED BY EMPLOYEE NUMBER** 4017-4641

**APPROVED BY EMPLOYEE NUMBER** 4017-4641

---

**PERFORMED**

**AS™

**SPECIAL CODE** 4024 (1) DUAITIVE AS ABOVE (5-38)

---

**RESULTS**

**DESCRIPTION**

---

**ASSISTING DEPARTMENTS**

---

**CODE** (39) LLL

**HOURS** (45) "000 001.01"

---

**CORRECTIVE MAINTENANCE JOB TICKET NUMBER**

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**03A (1) DUPLICATE AS ABOVE (5-38)

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**POOR ORIGINAL**
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**Unit 1 Staff Recommends Approval**

Approval [Signature]

Cognizant Dept. Head

Date ————

**Unit 2 Staff Recommends Approval**

Approval [Signature]

Cognizant Dept. Head

Date ————

**Unit 1 PORC Recommends Approval**

[Signature]

Chairman of PORC

Date ————

**Unit 2 PORC Recommends Approval**

[Signature]

Chairman of PORC

Date 8/30/78

**Unit 1 Superintendent Approval**

Date ————

**Unit 2 Superintendent Approval**

Date ————

Manager Generation Quality Assurance Approval

[Signature]

Date ————
DATA SHEET A
Motor Driven Emergency Feed Pump EF-P-2A Functional Test

1. Pump idle inlet pressure: 80 psig
2. Pump running inlet pressure (6.1.16 or 6.2.11): 80 psig
3. Pump running discharge pressure (6.1.17 or 6.2.12): 1470 psig
4. Calculated differential pressure (#3 - #2): 1390 psig
5. Lube oil level (Initial if satisfactory): 0.22
6. Pump Inboard Bearing Vibration (mils): 0.26

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<tr>
<th>QUANTITY</th>
<th>MEASURED VALUE</th>
<th>ACCEPTABLE RANGE</th>
<th>ALERT RANGE</th>
<th>REQUIRED ACTION RANGE</th>
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<td>1269 to 1392</td>
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<td>FLOW RATE (GPH)</td>
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<td>MAX VIBRATION (MILS)</td>
<td>0.26 V</td>
<td>0.0 to 1.0</td>
<td>&gt;1.0</td>
<td>&gt;1.5</td>
<td>.15 V</td>
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*Measurements taken only during first test run each calendar year.
## Valve Acceptance Criteria

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<th>Valve No.</th>
<th>Stroke Time (sec)</th>
<th>Acceptance Criteria</th>
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<tbody>
<tr>
<td>EF-V27A</td>
<td>OPEN in 1 sec</td>
<td>≤ 3 sec.</td>
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</table>

### Valve Function Requirement

- EF-V1A: (check valve) OPEN
- EF-V1B: (check valve) CLOSED
- EF-V2: (check valve) CLOSED

**PERFORMED BY:** J. Kohler  
**DATE:** 3/26/79  
**TIME:** 12:45

**APPROVED BY:** C. Guthrie  
**DATE:** 3/26/79

**ANALYSIS:** MEETS ACCEPTANCE CRITERIA

Analysis by: C. Guthrie  
**DATE:** 3/26/79  
**TIME:** 12:45

Analysis performed within 96 hours?  
Yes [X]  
No [ ]

**POOR ORIGINAL**
DATA SHEET B

Motor Driven Emergency Feedpump EF-P-2B Functional Test

1. Pump idle inlet pressure 75 psig
2. Pump running inlet pressure (6.1.16 or 6.2.11) 74 psig
3. Pump running discharge pressure (6.1.17 or 6.2.12) 1460 psig
4. Calculated differential pressure (\( \pi_3 - \pi_2 \)) 1386 psig
5. Lube oil level (Initial if satisfactory) E.T.
6. Pump Inboard Bearing Vibration (mils) H .5
   V .2

<table>
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<tr>
<th>QUANTITY</th>
<th>MEASURED VALUE</th>
<th>ACCEPTABLE RANGE</th>
<th>ALERT RANGE</th>
<th>REQUIRED ACTION RANGE</th>
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<td>&gt;1 to 1.5</td>
<td>NA &gt;1.5</td>
<td>.32V</td>
</tr>
</tbody>
</table>

*Measurements taken only during first test run each calendar year.
# DATA SHEET E (Cont'd)

<table>
<thead>
<tr>
<th>MANUFACTURE</th>
<th>CO-PI-2026</th>
<th>EF-PI-2001</th>
<th>CO-FE-7617</th>
<th>EAGLE EYE METER</th>
<th>VIBRATION INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DuBro Inc.</td>
<td>15Shen   F</td>
<td>15Shen</td>
<td>15Shen</td>
<td>Kaplan</td>
<td>IDO</td>
</tr>
<tr>
<td>MODEL</td>
<td>2111</td>
<td>DuBro</td>
<td>DuBro</td>
<td></td>
<td>304</td>
</tr>
<tr>
<td>SERIAL NO.</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>51471144</td>
</tr>
<tr>
<td>SCALE RANGE</td>
<td>0-300°</td>
<td>0-2000</td>
<td>0-10&quot;</td>
<td>1-100</td>
<td></td>
</tr>
</tbody>
</table>

PERFORMED BY: J. Klorin  
DATE: 3/26/79  
TIME: 8:40

APPROVED BY: C. Truluck  
DATE: 3/26/79

## Valve No.  
Stroke Time (sec.)  
Acceptance Criteria

<table>
<thead>
<tr>
<th>Valve No.</th>
<th>Open in</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF-V27D</td>
<td>1 sec.</td>
<td>≤ 3 sec.</td>
</tr>
</tbody>
</table>

## Valve No.  
Valve Function Requirement  
Date/Initial

<table>
<thead>
<tr>
<th>Valve No.</th>
<th>Valve Function Requirement</th>
<th>Date/Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF-V1 B</td>
<td>(check valve) OPEN</td>
<td>3/26/79</td>
</tr>
<tr>
<td>EF-V1A</td>
<td>(check valve) CLOSED</td>
<td>3/26/79</td>
</tr>
</tbody>
</table>

PERFORMED BY: K. Klorin  
DATE: 3/26/79

APPROVED BY: C. Truluck  
DATE: 3/26/79

## Analysis:
Meets Acceptance Criteria

Analysis by: C. Truluck  
DATE: 3/26/79  
TIME: 

Analysis performed within 96 hours? Yes ______  No ______

POOR ORIGINAL
(1) Time the last surveillance test was run on the E&W system?

Ans - 1000 - 1245 3/26/79

(2) Do the E&W V-12's have position indication on the rear panels?

Ans - Yes, there is open/shut indication on the front panels and in Panel #15, plus the local control switch located in the Control Bldg. [Note: the local switch is not a key lock switch]

(3) Are tags used when valves are repositioned for surveillance tests?

Ans - No! Tags are primarily for personnel & equipment protection. A step-by-step procedure is considered satisfactory for testing.
4) Obtain a record of the 4/1/79 surveillance test?

ANS - attached are the cover sheets of all surveillance tests performed on the EFV thus far. 7.

5) Can the EF-V-12's be locally operated?

ANS - yes.

6) What was the purpose of the caution tag which was obstructing the view of the EF-V-12 (A&B) position indicator lights?

ANS - The yellow tag dated 7/4 was attached to an EF-V-16 Control Panel states "Please signal to Controller is bad"
As procedure 2303-M27A/B run twice once for each motor driven pump.

ANS. NO. The valve line up

per appendix A & B of the procedure is established at one time. It should be noted that only 6 of the 19 valves are unique to either the A or B system, while the remainder are the same valves. The pumps are then run, one at a time, and data is taken prior to shutting it down or starting the next one.

It should be noted that the valve line up appears to be too extensive. It places both EEW ties to the S/C's out of service which is probably a tech spec violation. It appears as though each pump could be tested without disabling the other 2 pumps or affecting their ability to feed either S/C.
What changes were incorporated into Rev.

ANS - see attached procedure

change request. It should be noted
that, prior to the revision EFU-12A
did not have to be shut down to perform
the test. The procedure was revised 8/3
because EFU-11 & B values, which are critical values, are
not sufficiently tight to permit the pump tests.

How are surveillance tasks assigned to
operating staff.

ANS. - The extra shift on days
the routine surveillance tests. The
surveillance test coordinator brings the
computer print out sheets for that week
to the control room. The extra
(relief shift) shift foreman reviews the
weekly schedule on a daily basis
and arranges for his crew to do the...
...testing in conjunction with the crew
running the control room.
Observations

(1) The 2 men who signed the surveillance test form (computer printed) for the test conducted on 3/26/79 stated that they felt their signature only pertained to the test form and its attached data sheets, and does not imply that the test system values were properly realigned.

(2) An Aux operator stated that if he found a value in an improper position while conducting a Value line up verification, it would most probably be corrected (after discussing it with the Control Room) but not notice on the data sheet.

(3) The work sheets (check of lists) which are used to conduct a surveillance test are not retained. The Aux Operator most probably turns them over to the CRE who discards them.
then. The Shift foremen do not review them. (although this may not be type of all shift crews, it is for the crew that did the 3/26 surveillance on the EFW system.)

4) There was no maintenance performed on the EFW system between 3/26 and 3/28 which would have required the EFW-12's to be shut.

5) At 0400 on 3/28/79 the operating crew was not setting up to do a EFW surveillance test. I am surveillance tests are performed on days by the relief shift.
Possible explanation for EF-V-12 AE 48 being shut on 3/28/79 at 0400.

The investigation of this subject conducted by TG Miller & EF0. Conn on April 12 & 13, 1979, did not uncover why the valves were shut at 3/28/79 at 0400. There are forever three possible explanations.

1) The values were not reopened at the conclusion of the 3/26/79 test. The aux operator who conducted the test remembers speaking to 2 CRO's at the EFW pump as the system was being redefined to normal. He does not remember viewing the position indicators for the EF V-12's. Most probably one CRO thought the other had redefined the values while neither actually did.

2) In the excitement of the first minute of the incident on 3/28/79, the CRO may have mistakenly shut the EFV-12

3) The valves could have been shut mistakenly from the local control
Observations (Cont'd)

Ref. a) pp 7; (3) pp 5

The C.R.O. assigned in Relief Shift during testing 1/26/74 on EF-W system stated that he remembers the Aux. Ope. reading off values to be recorded at the completion of the test, but he does not remember whether he performed the operation of EF-U-12 values or whether the C.R.O. or Operator performed the operation. He stated they were both standing at the board and both responding alternately, apparently although he was positive on this point, it confirms the report given by the Aux. Ope.

The C.R.O. also stated that the Aux. Ope. gave him the Check-O/Sheets when the test was completed and that he threw them into waste basket. He stated that until a few months past, the work sheets were kept on file but the number made it impractical to keep, since the record on the was not considered necessary or important.
Prof. - Joe R. Bushell (Dave Good Trail, I, E. March 1943, Ext. 346-98)

Freq. - ASME Sect. 11 (10 CFR 50)

Sel. EFPI'S - Monthly tests during normal ops.

Values - 1/4'ly


Dir. Depended on Unit's system status. But since these values normally closed

Rev. 4 - Inv. Unit's because Unit's not

Violation of Tech Spec.:

Enter action statement for Sure. Testing CWR.

Both Unit's not questionable.

If not acceptable:

To lead ME or 951 coordinator in analysis within 96 hrs.

(Practically if failed pump would receive immediate attention.)
EF Pump Surveillance Procedure

Basis for schedule:
10 CFR 50 include requirement 7
BSME Sect. II 1970 edition thru summer
Pumps - Monthly test during normal operation
Valves - Quarterly

Basis for method:
Tech. Spec. refers to BSME Sect. II (Gen. Special requirements for EFU-2) (Steam Turb.)

Consistency with Tech. Spec.
Original written to depend on EFU-11 values to serve as shut-off values because they are NC.
With the arrangement system would be
an auto-including EFU-11 values and the
would comply with Tech. Spec.
EFU-11 values not sufficiently tight for
test and Rev. 4 included closing EFU-12 values so test could be properly accomplished.

The thinking was that by entering a
statement for surveillance testing this would meet Tech. Spec. but this is questionable.
Step by step execution in field:

Copy of step by step procedure sheet given to Aux Oprs and CRD and this is the central for conducting the test.
Aux Oprs checks off each step as it is accomplished.

After test is completed the sheet are given to CRD and be discarded.

History of Preparation of Rig Procedure:
See above. "Conformity with Tech Specs"

Review and Approval of Surveillance Results:
Aux Oprs sign "perform".
Shift Foreman signs "approved" in results within allowable limits or states condition as not.

Head M.E. or S51 Coordinator and made within 96 hrs for action if needed. Actually unsat. conditions would record immediate attention.
Results & Discussion:

Sect 11: Regression Testing

Appr 30

3 6/7 P 3 H2SO4

3 Hz SO4. 2 Decay test room
2 decay heat
2 decay heat removal pump
2 " interim C to shell
3 make-up
2 receive oil & carboxylic
2 screen wash
2 screen house vent, carboxylic

Appr 300 values per 1/4 hr

When system designed Sect 11 not a known refinement.

Mark Bezerra
Emergency D.W. Sys.
EF-U12A & EF-U12B closed
Rx power 97.7
P ISR spray thru m manual
2 cond. 2 boilers, 2 D.W. pumps
B make-up pump 45 gpm, let-down flow
7 desim towers 17, 1 regenerator

A cond. pump tripped
Valves m polisher closed, bleed tie flow
100% open

T.W.P. tripped
T-G tripped m loss of T.W.
25 P. reactor vessel
2255 psi electromagnetic ele. lift

Contini tag block x 1. O.C. lights on board ??

Loss of D.W. most severe transient
Instantaneous - full pump on via etc.
1 Min. keep remember