

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-346/85013(DRS)

Docket No. 50-346

License No. NPF-3

Licensee: Toledo Edison Company
Edison Plaza, 300 Madison Avenue
Toledo, OH 43652

Facility Name: Davis-Besse Nuclear Power Station, Unit 1

Inspection At: Davis Besse Site
Oak Harbor, OH
Bechtel Power Corporation, Gaithersburg, MD (Bechtel)

Inspection Conducted: March 26-27, April 24-26, May 28-31, and
July 8-11, 1985 at site
July 29-August 2, 1985 at Bechtel

Inspector: *I. Yin*
I. T. Yin

8/26/85
Date

Approved By: *D. H. Danielson*
D. H. Danielson, Chief
Materials and Processes Section

8/27/85
Date

Inspection Summary

Special Inspection from March 26 through August 2, 1985 (Report No. 50-356/85013(DRS))

Areas Inspected: Special, announced inspection of the auxiliary feedwater pump turbine steam supply (AFPTSS) piping restraint and structural damage. The inspection involved a total of 116 inspector-hours on site and at the A-E's office by one NRC inspector.

Results: Within the areas inspected, four apparent violations were identified (failure to issue nonconformance reports when hanger damage was identified - Paragraph 6; inadequate corrective actions were taken to determine the cause of hanger damage so that preventive measures could be initiated - Paragraph 7; inadequate QC and IE Bulletin No. 79-14 inspections were performed to verify hanger installations were per design requirements - Paragraph 8; failure to report the total extent of damage to the AFPTSS to the NRC per 10 CFR 50.73 requirements - Paragraph 13).

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DETAILS

1. Persons Contacted

Toledo Edison Company (TECo)

- *+D. R. Wuokko, Licensing Supervisor
- *+P. H. Straube, Senior Engineer
- * J. K. Wood, Facility Engineering General Supervisor
- * C. T. Daft, QA Director
- *+S. Osting, Senior Assistant Engineer
- * G. N. Ferguson, Associate Engineer
- * J. Helle, Director, Nuclear Facility Engineering
- * T. Murray, Assistant Vice President, Nuclear Operations
- R. Acherman, Assistant Engineer
- T. Hiss, Mechanical Engineering Supervisor
- M. B. Raynes, Assistant Engineer
- * C. Rupp, Senior Assistant Engineer
- F. R. Miller, Staff Engineer
- W. T. O'Connor, Operations Superintendent
- D. Rhodes, QC Supervisor
- J. Lingenfelter, Technical Engineer
- S. Jain, Senior Engineer
- D. Missig, Senior Assistant Engineer
- D. Wilczynski, Senior Assistant Engineer

Bechtel Power Corporation (Bechtel)

- *+R. Kies, Engineering Supervisor
- +J. Fay, Project Engineer
- N. Tolani, Senior Engineer
- J. M. Ogle, Civil Group Supervisor
- C. H. Abutaa, Senior Engineer
- R. R. Zeigler, Engineer
- S. D. Kline, Engineer
- +M. H. Franzen, Civil Assistant Group Supervisor

MPR Associates, Inc. (MPR)

- P. C. Hildebrandt, Consultant
- R. G. Starck, Consultant

USNRC - Region III (RIII)

- * I. N. Jackiw, Chief, Projects Section 2B
- * W. Rogers, Senior Resident Inspector

*Denotes those attending the management exit meeting on July 11, 1985.

+Denotes those attending the management exit meeting on August 2, 1985, at Bechtel.

2. General Description of the Events

In March 1985 the inspector was informed that a number of restraints installed on the AFPTSS piping system were found damaged. The affected restraints and structures were largely located on Line 6-EBD-19, downstream of the two auxiliary steam line check valves and downstream of the two crossover leg check valves to Auxiliary Feedwater Pump Turbines 1-1 and 1-2. Component and structural damage was also identified on a tie line between the two turbines. In response to the inspector's requests, pertinent flow diagrams, piping isometric drawings, damage descriptions, and details for those damaged restraints were sent by the licensee to the inspector for review on March 20, 1985.

3. Damage Reported on March 20, 1985

a. Train No. 1-1

<u>Hanger No.</u>	<u>Date Identified</u>	<u>Licensee Findings</u>
H 132	03/15/85 .	. gaps between base-plate and wall
H 34	03/13/85	. deformed pipe stanchion
H 32	03/15/85	. loosened bolts . pipe clamp moved
H 28	03/15/85	. pipe saddle deformed
H 25	03/15/85	. bolt head sheared off
H 14	03/16/85	. snubber misalignment
H 135	03/15/85	. one loosened bolt . gaps between base plate and wall
H 66	03/15/85	. Same as H 135

b. Train No. 1-2

<u>Hanger No.</u>	<u>Date Identified</u>	<u>Licensee Findings</u>
H 50	03/14/85	. loosened bolts . gaps between base plate and wall
H 49	03/14/85	. bolts pulled from wall . gaps between base plate and wall
A 3	03/13/85	. loosened bolts
H 142	03/14/85	. same as H 49
H 144	03/01/85	. snubber piston rod sheared
H 147	03/01/85	. strut pulled from wall

4. Snubber Functional Tests

In accordance with the corrective action agreements between RIII and TECo, the licensee tested all AFPTSS snubbers (except those installed on the crossover legs) to check their functionabilities. The testing was conducted in accordance with Bechtel procedure M-618, "Piston Settings, Locking Velocities, and Bleed Rates for Mechanical and Hydraulic Snubbers," Revision 16, dated May 14, 1985. The tests were conducted from March 25 to April 17, 1985. Among the 21 snubbers tested, hydraulic snubbers Nos. H 52 and H 12 and mechanical snubber No. H 58 were found inoperable. The inspector reviewed the test data and found that the snubbers did not meet the Bechtel acceptance criteria by small amounts. The Bechtel specification appeared to be very stringent compared to common industrial standards. The inspector agreed with TECo that no further testing was required.

5. Non-Destructive Examination (NDE) of AFPTSS Lines

In accordance with the corrective action agreements between RIII and TECo, the licensee performed NDE on the portions of the AFPTSS lines that are: (a) in the vicinity of snubber and strut failures, (b) in high stress areas determined by analysis, and (c) at pipe fittings with high stress intensification factors. The NDE program and result evaluations are documented in TECo Surveillance Report No. 85-M-09 dated March 28, 1985. The MT and PT performed by Exam Corporation on the weld locations specified by Bechtel did not reveal any rejectable indications. The inspector reviewed the pertinent documentation, and did not have any adverse comments.

6. Documentation of Nonconformances

a. Failure to Issue Nonconformance Reports (NCRs)

On April 24-26, 1985, the inspector reviewed NCRs documenting the AFPTSS restraint failure problems. The H 144 and H 147 deficiencies were identified by craft personnel working in the auxiliary feedwater pump room on March 1, 1985. NCR No. 85-0016 was issued on March 3, 1985. On March 13, 1985, a general inspection of the area was performed by QC personnel. During this inspection the A 3 and H 34 deficiencies were observed, and NCR Nos. 85-0018 and 85-0019 were issued on the same date. In NCR No. 85-0019, QC personnel "...suggested to station that a walk-down of both trains be done to determine if other damage may be present." The site Facility Engineering Department (FED) subsequently performed inspections. The deficiencies (those listed in Paragraph 3 above except H 144, H 147, H 34, and A 3) identified by FED were not documented in NCRs.

b. Use of Sketches In Lieu of NCRs

On July 29 - August 2, 1985, the inspector reviewed the Bechtel evaluation of the A 3 damage conditions. The A 3 pipe anchor is an important restraint in that it is the point where Bechtel piping stress analyses No. 40A and No. 40B are separated. The adverse conditions found at A 3 could invalidate these two analyses.

NCR No. 85-0018 dated March 13, 1985, documented that the top 2 bolts were loosened on A 3, but did not provide dimensional information on the gaps found between the nuts and baseplate or gaps found between the baseplate and wall. Bechtel requested information on these gaps.

For gaps between nuts and baseplates TECo informed Bechtel by telephone on March 18, 1985, that the gaps were approximately $\frac{1}{4}$ " (based on FED measurements conducted on March 15, 1985). Bechtel Calculation No. A 3, File R1, "Anchor A 3," Revision 10, performed on March 16, 1985, and approved on June 7, 1985, showed that the bolt stress safety factor was 2.4 which met the operability safety factor criteria of 2.

After the loosened top bolts were torqued, gaps ranging from $\frac{1}{16}$ " to $\frac{3}{16}$ " were found between the baseplates and walls surrounding approximately 70% of the plate edges. A sketch of the deficiencies was made by the TECo site staff and was sent to Bechtel for evaluation on May 14, 1985. The sketch did not show the dimensions of the gaps. Based on Bechtel's request, an additional TECo sketch was sent on May 16, 1985, showing the gap area dimensions. Subsequently, TECo issued NCR No. 85-0065 on May 16, 1985, documenting the problem.

The failure to document nonconformances and forward them to the A-E's for evaluation rather than the use of uncontrolled sketches is not in accordance with TECo Nuclear QA Procedure No. 2150, "Nonconformance," Revision 4, dated April 23, 1976, requirements. This is a violation of 10 CFR 50, Appendix B, Criterion XV (346/85013-01).

7. Review of TECo Maintenance Work Orders (MWOs)

On April 24-26, 1985, the inspector reviewed the following TECo MWOs related to the AFPTSS restraint failures:

<u>MWO No.</u>	<u>Date Issued</u>	<u>Date Closed</u>	<u>Restraint No.</u>
2-85-0086-01 (NCR 85-0016)	04/22/85	04/24/85	H 147
1-85-0936-01 (NCR 85-0016)	03/04/85	03/08/85	H 144
1-85-1056-02 (NCR 85-0018)	03/18/85	03/21/85	A 3
1-85-1058-00	03/15/85	04/11/85	H 133, 32, 135, 66
1-85-1060-00	03/17/85	03/22/85	H 28, 25
1-85-1076-00	03/19/85	03/21/85	H 32, 14
1-85-1104-00	03/21/85	03/28/85	H 142, 50, 49, 34, 135, 26
1-85-1104-01	03/22/85	Open	H 49, 50, 142
1-85-1104-02	03/22/85	04/19/85	H 10, 67
1-85-1104-04	03/23/85	Open	H 32, 34, 142, 135
1-85-1104-05	03/25/85	04/19/85	H 49, 50

The inspector reviewed the "Safety Evaluation for Facility Change Request No. 85-0071," dated March 26, 1985, and safety evaluations included in NCR Nos. 85-0016 and 85-0018 for the disposition of the above defective restraints and affected concrete and structures. The evaluations did not investigate the cause of the problem and consequently measures to prevent recurrence were not developed. This is a violation of 10 CFR 50, Appendix B, Criterion XVI (346/85013-02).

8. Piping Suspension System As-Built Evaluations

On May 28-31, 1985, during the inspector's review of NCRs and MWOs he identified that the inspections by the TECo staff were conducted without procedures and acceptance criteria. The inspection areas where procedures should have been established and followed included torque testing of concrete expansion anchor bolts, and inspections for location, configuration, orientation, component alignment, cold position setting, and general physical condition of piping hangers. TECo subsequently

developed procedures for systematic determination of support and structure damage, and for establishing baseline inspection records so that possible damage resulting from future AFPTSS testing could be easily identified. The procedures issued for these purposes were:

- ° TECo Maintenance Procedure, MP 1408.01, "Piping Support Expansion Anchor Testing," dated April 25, 1985.
- ° TECo QC Section, QCIP-006, "Inspection of Piping Hangers, Supports, and Restraints," Revision 0, dated May 3, 1985.
- ° TECo QC Section Checklist No. QCCL-36, "Piping Systems Observation Checklist," Revision 0, dated May 13, 1985.

The testing and inspections were conducted in May and June 1985. The inspector reviewed the following NCRs that were issued as a result of the TECo inspections:

Train No. 1-2

<u>NCR No.</u>	<u>Date Issued</u>	<u>Type of Inspection</u>	<u>Description</u>
85-0042	04/30/85	bolt test	H 136 was found having 12 bolts instead of 7 specified by design.
85-0043	04/30/85	bolt test	H 54 welding not in accordance with design.
85-0044	04/30/85	bolt test	H 51 bolts out of plumb. Washer and baseplate lacked full load bearing.
85-0045	05/01/85	bolt test	H 142 one bolt failed torque test.
85-0046	05/02/85	bolt test	H 59 insufficient bolt embedment depth.
85-0048	05/08/85	baseline	H 59 snubber fluid reservoir installation not per design. (documentation problem)
85-0052	05/08/85	baseline	H 51 incorrect spring can setting.
85-0052A	05/08/85	baseline	H 51 pipe clamp and wall interference.

<u>NCR No.</u>	<u>Date Issued</u>	<u>Type of Inspection</u>	<u>Description</u>
85-0053	05/08/85	baseline	H 50 found spalled (chipped out) concrete.
85-0054	05/09/85	baseline	H 143 fire proofing material missing.
85-0056	05/09/85	baseline	H 154 shim size for gap incorrect.
85-0057	05/09/85	baseline	H 62 found missing or damaged fireproofing material.
85-0058	05/09/85	baseline	H 60 spring can size incorrect.
85-0059	05/10/85	baseline	H 141 torn pipe penetration rubber seal.
85-0060	05/14/85	after pump test	H 49 bolts observed pulled out during test.
85-0065	05/16/85	baseline	A 3 inadequate wall bearing surface behind baseplate.
85-0066	05/16/85	baseline	H 142, 144, 145, and 147. Similar to NCR 85-0065.
85-0067	05/17/85	Note 1	H 145 sway strut rod end jam nut found loose.
85-0068	05/17/85	Note 1	H 62 snubber pipe clamp and rod end jam nut found loose.

Train No. 1-1

<u>NCR No.</u>	<u>Date Issued</u>	<u>Type of Inspection</u>	<u>Description</u>
85-0069	05/17/85	snubber inspection	H 20 support not exist on hanger location drawing.
85-0064	05/16/85	baseline	H 1 (EBD-20-H1) bolts loosened due to test.

<u>NCR No.</u>	<u>Date Issued</u>	<u>Type of Inspection</u>	<u>Description</u>
85-0070	05/17/85	Note 2	H 14 snubber pipe clamp and base plate bolts found loose. Pipe clamp found misaligned.
85-0071	05/22/85	baseline	H 25 guide angle steel found bent.
85-0072	05/22/85	baseline	H 132 and 133. Fire proofing material broken.
85-0074	05/24/85	baseline	H 13, 13A, 15, 16. Sway strut jam nut loosening.
			H 74, 26, 36, 37. Insulation missing or damaged.
			H 19 3 of 4 sway strut pins have nails instead of cotter pins.
			H 20, 32, and 33. Misalignment.
			H 133 pipe clamp loosened.

Note 1: Deficiencies were found during the 04/18/85 surveillance walk-down.

Note 2: Deficiencies were found during the 04/12/85 walkdown surveillance.

Subsequent to the review, the inspector separated the defective hangers into the following two groups:

Group 1 - Damages Due to Possible Transient Overload

° Loosened bolts and clamps:

H 142, 50, 49, 1, 145, 62, 14, 25, 13, 13A, 15, 16, 20, 32, 33, and 133.

° Fireproofing and seal material damage:

H 147, 62, 141, 132, 133, 74, 26, 36, and 37.

Group 2 - Construction and QC Deficiencies

H 136, 54, 51, 59, 154, 60, 142, 144, 145, 20, 19, and A3.

The inspector questioned why so many hangers had not been installed in accordance with the design drawing requirements. As a followup action, the following construction procedures were reviewed to check for program adequacy:

- ° ITT-Grinnell (ITT-G) SS-1379C, "Procedure for Field Installation and Inspection for All Q-listed and Seismic Class 1 Rigid Hangers, Variable Supports, Constant Supports, Hydraulic Snubbers, Struts, Seismic Restraints, and Anchors for Piping," Revision C, dated March 3, 1976.
- ° ITT-G Pipe Hanger Department "Instruction for As-Built Hangers," dated December 3, 1976.
- ° ITT-G "QA Manual of the ITT-Grinnell Corporation and Subsidiaries Field Construction for Toledo Edison Co. Davis-Besse Nuclear Power Station Q Listed Items Non-Nuclear Code," dated December 12, 1976, including ITT-G QA Manual Field Construction Standard QC procedure.

The inspector concluded that none of the above procedures provided measures to verify design location, configuration, orientation, condition, and to document nonconforming conditions during hanger construction and installation.

On May 28-31, 1985, the inspector further reviewed TECo implementation of the actions set forth in IE Bulletin IEB 79-14 for verifying that piping as-built conditions meet design analysis requirements. The inspector's review criteria were based on Bechtel procedure PDP-2, "Inspection Procedure for As-Built Configuration of Nuclear Safety-Related Piping Components IE Bulletin 79-14," Revision 4, dated May 3, 1980. The following Group 2 hangers were reviewed:

- ° H 136 (3A-EBD-19-H136), QC signoffs on May 28, 1976 and August 22, 1977

The Bechtel IEB 79-14 walkdown identified construction deficiencies on August 21, 1979. Contrary to the PDP-2, Paragraph D.2 requirement that "All noted discrepancies shall be categorized by system on a Master Punch List," the deficiencies were not punch-listed and therefore an NCR was not issued and an engineering evaluation was not conducted.

- ° H 54 (3A-EBD-19-H 54), QC signoffs on February 13, 1977 and August 22, 1977

The Bechtel IEB 79-14 walkdown did not identify the welding design deviation problem. PDP-2, Paragraph C.2.c.12 states that "Check that the extent of weld such as continuous, intermittent, tack,

both sides, all around, etc., is per design. Weld sizes and lengths greater than those specified on the drawing will be acceptable." That inspection requirement was not implemented.

- ° H 51 (3A-EBD-19-H 51), QC signoffs on March 17 and May 27, 1976

The Bechtel IEB 79-14 walkdown identified the spring setting deviation problem on August 21, 1979. As with H 136, it was not punch-listed.

- ° H 59 (3A-EBD-19-H 59), QC signoffs on March 8 and May 11, 1977

The Bechtel IEB 79-14 walkdown did not identified the snubber reservoir installation deviation condition. PDP-2, Paragraph C.2.c.20 states that "Where weights other than the subject piping are found attached to the pipe supports, they should be noted. The exceptions are:" The exceptions did not include snubber reservoir and mounting component structures. That inspection requirement was not implemented.

- ° H 154 (3A-EBD-19-H 154), QC signoffs on March 31, 1976 and March 30, 1977

Hanger was covered by insulation and the shim size could not be verified. This is allowed by IEB 79-14 (only 10% of all piping insulation was required to be removed for measurements).

- ° H 60 (3A-EBD-19-H 60)

Site Vendor Drawing Change Notice No. 79-421-00 was issued to replace the existing spring hanger ITT-G Figure 82, No. 2, Type F with a ITT-G Figure 82, No. 4, Type F. QC signoff was dated June 3, 1982. The actual spring hanger installed was a Power Engineering Company Size 501. This is a nonconforming installation that was not identified by QC inspection.

- ° H 20 (3A-EBD-19-H 20)

The Bechtel IEB 79-14 walkdown identified the existence of this hanger in the system. Bechtel design/drafting personnel failed to locate this hanger on the as-built isometric drawing.

- ° H 19 (3A-EBD-19-H 19), QC signoffs on May 7, 1976 and September 8, 1976

The condition where 3 of the 4 sway strut pins have nails instead of cotter pins was not documented as part of the Bechtel IEB 79-14 walkdown inspection.

The inadequate piping suspension system QC inspection and the ineffective implementation of the IEB 79-14 walkdown inspection program are violations of 10 CFR 50, Appendix B, Criterion X (346/85013-03).

9. Possibility of Other System Support Damages

The AFPTSS piping suspension system damage was initially identified by accident (Paragraphs 3 and 6). TECo has no systematic maintenance provisions to determine hardware conditions after system testing. The inspector stated that he suspected that other unidentified damage could have occurred in other systems which are designed for infrequent use but are subjected to periodic testing. Subsequently, TECo bolt test inspection of the auxiliary feedwater pump discharge line hangers inside the pump rooms identified the following additional hanger damage:

<u>NCR No. 85-</u>	<u>Hanger No. 6C-EBD-14-</u>	<u>Deficiencies</u>
0024	H 87	loosened bolts
0049	H 76	spalled concrete
0050	H 80	spalled concrete
0051	H 90	spalled concrete
0073	H 54	incorrect bolts
0075	H 69	1 loosened bolt
0076	H 68	loosened bolts
0077	H 67	incorrect bolts
0102	H 77	incorrect bolts
Not issued at the time of inspection	H 91	incorrect bolts

Subsequent to the inspection, a TECo letter to RIII (Serial No. 1-540), dated June 14, 1985, presented TECo's proposal to resolve the issues discussed above. This is an unresolved item pending RIII followup inspection (346/85013-04).

10. RIII Confirmatory Action Letter (CAL)

Following the Three Mile Island (TMI) incident, the licensee was requested by the NRC to improve the operability of the auxiliary feedwater system. A system operation procedure was changed to improve the steam supply for the auxiliary feedwater pumps by simultaneously opening the four motor operated gate valves on the two AFPTSS main supply lines and on the two crossover legs. This could have contributed to the various piping support component and structural damage identified in March 1985. During the RIII inspection conducted on March 26-27, 1985, the licensee stated that the AFPTSS mode of operation would be changed back to pre-TMI modification mode of operations. Subsequent to the system mode of operation change, the inspector was informed that H 144 and H 145 on Train No. 1-1 and H 14 and H 58 on Train No. 1-2 were damaged again. This prompted the issuance of RIII CAL No. 85-03 on April 26, 1985 (Attachment 1).

On May 28-31, 1985, the licensee implementation of RIII CAL-85-03 was reviewed by the inspector at the site. The status of the CAL items are as follows:

Item 1 (Closed)

- ° H 144 was evaluated in Bechtel Calculation No. 40B (C10) "MS System," dated May 29, 1985. The snubber failure load of 3,000 lbs. was modelled. The calculated maximum pipe stress was 14,132 psi.
- ° H 145 was evaluated in Bechtel Calculation No. 40B (C6) "MS System," dated May 9, 1985. The vertical rigid restraint failure load of 6,340 lbs. was modelled. The calculated maximum pipe stress was 22,751 psi.
- ° H 14 was evaluated in Bechtel Calculation No. 41A (C4), "MS System," dated May 9, 1985. The hydraulic snubber failure load of 13,000 lbs. (bolt failure) was modelled. The calculated maximum pipe stress was 12,289 psi.
- ° H 58 was evaluated in Bechtel Calculation No. 40B (C6), "MS System," dated May 9, 1985. The mechanical snubber failure load of 1000 lbs. was modelled. The calculated maximum pipe stress was 9,703 psi.

Item 2 (Closed)

The inspector reviewed concrete expansion anchor bolt test records, and had no adverse comments. The tests were conducted from April 29 through May 29, 1985.

Item 3 (Open)

The AFPTSS piping test procedures and instrumentation calibration procedures were reviewed and the inspector had the following comments:

- ° TECo letter to RIII (Serial No. 1-532), dated June 4, 1985, transmitted the following procedures:
 - TECo draft test procedure, TP 850.00, "Auxiliary Feedwater Pump Turbine Main Steam Piping Test Program (FCR 85-0087)," dated May 30, 1985.
 - MPR calibration procedure, "Test Load Cell Assembly Calibration Procedure Outline," dated May 3, 1985.
- ° On June 6, 1985, the inspector discussed his comments with TECo and MPR staff in a telephone conference.
- ° TECo letter to RIII (Serial No. 1-543), dated June 21, 1985, transmitted the following revised procedures:
 - TECo TP850.00.0, "Auxiliary Feedwater Pump Turbine Main Steam Piping Test Program," dated June 5, 1985.

- MPR calibration procedure, "Test Load Cell Assembly Calibration Procedure Outline," dated June 17, 1985.
- ° On June 24, 1985, the inspector commented on the calibration procedure during a telephone conference.
- ° On July 10, 1985, the inspector commented on TP850.00.0, dated June 5, 1985, at the site.
- ° On July 11, 1985, the inspector commented on the revised MPR calibration procedure, "Snubber Load Cell Calibration Procedure Outline," dated June 25, 1985 at the site.

The licensee stated that revised procedures will be forwarded to RIII for review.

Items 4 and 5 (Closed)

- ° For Train 1-1, the baseline inspection was conducted in May and June 1985. The first monthly pump test after the issuance of the CAL was conducted on May 23, 1985, by four QC and four engineering personnel in accordance with Test Procedure ST 5071.01 requirements. The damage observed was as follows:

- H 65 - the sway strut pipe clamp had dropped 3" on the pipe stanchion.
- H 17 - the sway strut jam nut was found loose.

- ° For Train No. 1-2, the baseline inspection was conducted in May and June 1985.

The first monthly pump test after the issuance of the CAL was conducted on May 13, 1985, by six QC and three engineering personnel in accordance with Test Procedure ST 5071.01 requirements. The discrepancies observed was as follows:

- H 49 - bolts were found loose
- H 58 - excessive pipe movement (1/4" to 1/2" lateral).
- H 144 - baseplate wall gap enlarged.
- H 147 - baseplate wall gap enlarged.

The second pump test was conducted on May 15, 1985 by QC and engineering personnel. The damage observed was as follows:

- Line movements were observed and the transient loads were heard.
- H 47 - cracks found at two of the four bolt baseplate grouts.

The above damage was verbally reported to RIII, and written reports were forwarded to RIII as follows:

- ° TECo letter to RIII (Serial No. 1-534), dated June 5, 1985.
- ° TECo letter to RIII (Serial No. 1-539), dated June 12, 1985.
- ° TECo letter to RIII (Serial No. 1-536), dated June 13, 1985.

11. AFPTSS System Operability

Prior to the inspection conducted on May 28-31, 1985, the operability of the AFPTSS system was not an apparent item of major concern to the NRC; however, after an indepth evaluation of NRC previous inspection results, a review of the above TECo reports and the damage continuing to occur from the events described below, operability required further evaluation. Before a determination could be made regarding continued operation while this operability evaluation was performed, the plant was shutdown as a result of the June 9, 1985, loss of feedwater event.

From the original 14 damaged hangers reported on March 20, 1985 (Paragraph 3), additional damaged hangers, excluding those having fire proofing damage, were documented in: (1) MWO issued during March and April 1985 (Paragraph 7), (2) NCRs issued during bolt test and baseline inspections conducted in May 1985 (Paragraph 8), and (3) surveillance reports issued during the monthly system test conducted in May 1985 (Paragraph 10). The large number of damaged hangers (some of them were damaged more than once) and gaps behind the hanger baseplates could be attributed to the following system activations and tests:

Train No. 1-1 Events from January to June 1985

<u>Event Date</u>	<u>Test Procedure or Trip (Note 1)</u>	<u>Description</u>
01/11/85	ST 5071.02	Full system test after plant refueling to verify that two independent steam generator auxiliary feedwater pumps and associated flow paths are operable. Phase 1: automatic pump start Phase 2: automatic valve actuation Phase 3: Mode 1 minimum recirculation flow at 3600 rpm Phase 4: Valve response from shutdown panel Phase 5 & 6: Check valve forward and reverse flow per ASME Code
01/11/85	ST 5071.01	Monthly system test
01/15/85	Trip	4 valves opened (Note 2)
01/30/85	ST 5071.01	Monthly system test

<u>Event Date</u>	<u>Test Procedure or Trip (Note 1)</u>	<u>Description</u>
02/04/85	ST 5071.01	System test request by Station Review Board
02/07/85	ST 5071.01	Valve MS 106 stroke test
02/27/85	ST 5071.01	Monthly system test
03/21/85	Trip	4 valves opened (Note 2)
03/27/85	ST 5071.01	System test requested by Station Review Board (use auxiliary steam)
04/08/85	ST 5071.01	Monthly system test (use auxiliary steam)
04/11/85	ST 5071.01	Monthly system test
04/12/84	ST 5071.02	Phase 1 testing only (to ensure system operability after turbine 1-2 found not meeting the Tech Spec response time)
04/24/85	Trip	Valves MS 106 and MS 107 opened (See Note 2)
04/24/85	ST 5071.01	Monthly system test
05/23/85	ST 5071.01	Check minimum pump recirculation
05/23/85	ST 5071.02	Phase 1 testing only. Test was requested by Deviation Report Subcommittee. Licensee staff observed piping during test. Walkdown inspection was completed on 5/24/85 (Report 85-M-37, dated 5/30/85).
06/02/85	Trip	Valves MS 106 and MS 107 opened (Note 2). Visual inspection was conducted on 6/2/85. Detailed inspection was conducted on 6/4/85 (Report 85-M-43, dated 6/7/85).
06/03/85	ST 5071.02	Phase 1 testing only. Operability check after maintenance was performed on turbine governor. Licensee staff observed piping during test. Walkdown inspection was completed on 6/4/85 (Report 85-M-43, dated 6/7/85).

<u>Event Date</u>	<u>Test Procedure or Trip (Note 1)</u>	<u>Description</u>
06/09/85	Trip	Valve MS 106, MS 106A, and MS 107A opened. Visual inspection was conducted on 6/9/85.
06/09/85	ST 5071.02	Phase 1 testing only. Operability check after plant trip. Licensee staff observed piping during test. Walkdown inspection was completed on 6/10/85 (Report 85-M-48, dated 6/12/85).

Train No. 1-2 Events from January to June 1985

<u>Event Date</u>	<u>Test Procedure or Trip (Note 1)</u>	<u>Description</u>
01/04/85	ST 5071.02	Phases 1 to 6 testings
01/04/85	ST 5071.01	Monthly system test
01/15/85	Trip	4 valves opened (Note 2)
02/01/85	ST 5071.01	Special test
02/13/85	ST 5071.01	Monthly system test
03/11/85	ST 5071.01	Monthly system test
03/21/85	Trip	4 valves opened (Note 2)
04/11/85	ST 5071.02	Phase 1 testing only. Test was suspended because turbine speed failed to meet Tech Spec response time.
04/12/85	ST 5071.02	Phase 1 testing only. Operability check after turbine speed bushing changeout per Facility Change Request.
04/18/85	ST 5071.01	Monthly system test
04/24/85	Trip	Valves MS 106 and MS 107 opened (See Note 2)
05/13/85	ST 5071.01	Test suspended because flow was out of Tech Spec. Licensee staff observed piping during test. Walkdown inspection was completed on 5/14/85 (Report 85-M-29, dated 5/16/85).

<u>Event Date</u>	<u>Test Procedure or Trip (Note 1)</u>	<u>Description</u>
05/15/85	ST 5071.01	Re-test after flow instrument recalibration. Licensee staff observed piping during test. Walkdown inspection was completed on 5/16/85 (Report 85-M-30, dated 5/20/85).
05/21/85	ST 5071.04	See Note 3. Inspection was conducted on 5/22/85 (Report 85-M-36, dated 5/28/85).
06/02/85	Trip	Valves MS 106 and MS 107 opened (Note 2). Visual inspection was conducted on 6/2/85. Detailed inspection was conducted on 6/4/85 (Report 85-M-44, dated 6/7/85).
06/06/85	ST 5071.01	Monthly system test. Licensee staff observed piping during test. Walkdown inspection was completed on 6/7/85 (Report 85-M-48, dated 6/12/85).
06/09/85	Trip	Valves MS 106, MS 106A, and MS 107A opened due to operator error. Visual inspection was conducted on 6/9/85.
06/09/85	ST 5071.02	Phase 1 testing only. Operability check after plant trip. Licensee staff observed piping during test. Walkdown inspection was completed on 6/10/85 (Report 85-M-48, dated 6/12/85).

Notes:

1. Trip means steam and feedwater rupture control system (SFRCS) activation.
2. Prior to January 4, 1985, the AFPTSS operation procedure required delivery of steam from Steam Generator (SG) 1-1 to Auxiliary Feedwater Pump Turbine 1-1, and from SG 1-2 to Auxiliary Feedwater Pump Turbine 1-2 or through crossover legs if one of the main steam (MS) supplies experiences a drop in pressure. The power operated valves installed on MS 1-1, MS 1-2, the crossover leg from SG 1-1 to turbine 1-2, and the crossover leg from SG 1-2 to turbine 1-1

are MS 106, MS 107, MS 107A, and MS 106A respectively. Since January 4, 1985, in order to improve the auxiliary feedwater system operability, all four valves were required to open during SFRCS activation. However, on April 2, 1985, after numerous piping supports and structures were found damaged (could have been caused by dynamic transient overloads), the operation procedure was restored to the original (prior to January 4, 1985) mode of operations.

3. ST 5071.04 is a general test procedure for checking functionality of valves MS 106A and MS 107A. On May 21, 1985, the operator should have pushed switch No. HIS 107E to open MS 107A, but erroneously pushed switch No. HIS 107A which opened MS 107 instead. MS 107A has a built-in interlocking device that shuts off the valve as soon as the valve closure light goes out during testing, but MS 107 does not have this interlocking mechanism. In this incident, instead of a puff of steam being sent from SG 1-1 to turbine 1-2, a full thrust of steam was rushed from SG 1-2 to turbine 1-2. Some line movement was observed by the TECo testing staff who were in the turbine area.

In accordance with the plant Technical Specifications, a safety system that is determined to be inoperable should be restored to an operable condition within 72 hours while the redundant system is still in an operating condition, or the system should be placed in the Mode 4 condition within the next 12 hours. Whether or not this Technical Specification requirement was violated was the subject of a followup inspection conducted at Bechtel on July 29 through August 2, 1985.

During the July 29 - August 2, 1985, inspection, the inspector determined that although extensive evaluations were completed by Bechtel relative to the AFPTSS operability, there were no consistent and systematic ways to assess the system condition prior March 1, 1985 (first identification of gross hanger damage) and the subsequent deterioration or improvement of system in terms of system operability. The need to develop a program covering the following operability criteria were discussed during the inspection.

- ° Analytical methodology to be used for resolving operability issues including piping overstress, hanger load increases and equipment nozzle loading combinations that exceed the manufacturer's allowables.
- ° Justification for using IEB 79-02, IEB 79-14, and the Bechtel developed alternative equipment nozzle stress criteria.
- ° Definition of short-term piping system operation prior to restoring piping components to their original (undamaged) conditions.

The inspector reviewed Bechtel's case-by-case evaluation of hanger damage and the resulting deficiencies for AFPTSS Trains 1-1 and 1-2. A summary of the reviews are documented in Table 1 and Table 2 which follows:

TABLE 1

Summary of Train 1-1 Hanger Damages and Deficiency Evaluations

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
6	90 (6/6/85)/gaps		Acceptable (Note No. 1)
8	90 (6/6/85)/gaps		Acceptable (Note No. 1)
9	90 (6/6/85)/gaps		Acceptable (Note No. 1)
10	90 (6/6/85)/gaps		Acceptable (Note No. 1)
12	90 (6/6/85)/gaps	Note No. 2	Acceptable
13	Surveillance Report (SR) 85-79 (6/28/85)/ loose jam nut	TECo Review	Acceptable
13A	94 (6/11/85)/strut and clamp interference	41A, Rev. 5 8/20/82	Acceptable
14	° 19A (3/14/85)/ snubber and clamp misalignment	Note No. 2	Inactive
	° 92 (6/6/85)/ threaded rods in lieu of bolts	41A-10, Rev. 1, 6/28/85	Acceptable
15	74 (5/24/85)/loose jam nut	TECo review	Acceptable
16	94 (6/11/85)/loose pipe clamp	41A (C7), 7/6/85	Inactive
18	92 (6/6/85)/loose strut	TECo review	Acceptable
19	74 (5/24/85)/nails in lieu of cotter pins	TECo review	Acceptable
20	° 92 (6/6/85)/ threaded rods in lieu of bolts	41A-17, Rev. 1, 6/28/85	
	° SR 85-73 (5/20/85)/ cracked concrete	TECo review	Acceptable

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
21	90 (6/6/85)/gaps		Acceptable (Note No. 1)
22	° SR 85-73 (5/20/85)/ cracked concrete	TECo review	Acceptable
	° 90 (6/6/85)/gaps		Acceptable (Note No. 1)
23	90 (6/6/85)/gaps		Acceptable (Note No. 1)
24	90 (6/6/85)/gaps		Acceptable (Note No. 1)
25	71 (5/22/85)/bent guide angle	41A-21, Rev. 2, 6/4/85	Acceptable for short-term use
26	° SR 85-73 (5/20/85)/ cracked concrete	TECo review	Acceptable
	° 90 (6/6/85)/gaps	Note No. 2	Acceptable
28	19A (3/14/85)/ deformed saddle	41A (C5), 6/26/85	Inactive (The saddle was repaired for short-term use)
32	° 19A (3/14/85)/ loose bolts, misalignment, missing washers	41A (C5), 6/26/85	Inactive
	° 26 (3/27/85)/ nonconforming weld	1-85, Rev. 1, 6/6/85	Acceptable
	° 74 (5/24/85)/ misalignment	41A (C5), 6/28/85	Inactive
33	74 (5/24/85)/strut free to rotate	Note No. 2	Acceptable
34	19A (3/14/85)/ deformed stanchion	41A (C5), 6/26/85	Inactive (The stanchion was repaired for permanent use)
65	90 (6/6/85)/gaps		Acceptable (Note No. 1)
66	° 90 (6/6/85)/gaps	40B (C13), 7/11/85	Acceptable for short-term use
	° 19A (3/14/85)/ loose bolts	Note No. 2	Inactive

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
67	° 90 (6/6/85)/gaps		Acceptable (Note No. 1)
	° 92 (6/6/85)/gap on restraint	40B, Rev. 6 6/8/81	Acceptable
	° SR 85-73 (5/20/85)/cracked concrete	TECo review	Acceptable
68	° 90 (6/6/85)/gaps		Acceptable (Note No. 1)
	° SR 85-73 (5/20/85)/cracked concrete	TECo review	Acceptable
70	92 (6/6/85)/loose jam nut	TECo review	Acceptable
72	90 (6/6/85)/gaps	Note No. 2	Acceptable
74	90 (6/6/85)/gaps		Acceptable (Note No. 1)
131	90 (6/6/85)/gaps	120F, Rev. C2, 7/6/85	Acceptable for short-term use
132	° 90 (6/6/85)/gaps	120F, Rev. C2, 7/6/85	Acceptable for short-term use
	° 19A (3/14/85)/loose bolts	Note No. 2	Inactive
133	90 (6/6/85)/gaps	120F, Rev. C2, 7/6/85	Acceptable for short-term use
135	90 (6/6/85)/gaps		Acceptable (Note No. 1)
148	90 (6/6/85)/gaps		Acceptable (Note No. 1)
150	° 90 (6/6/85)/gaps		Acceptable (Note No. 1)
	° SR 85-73 (5/20/85)/cracked concrete	TECo review	Acceptable
A362	90 (6/6/85)/gaps	Note No. 2	Acceptable
EBD-20-H1	° 64 (5/16/85)/gaps	40B, Rev. C9, 5/29/85	Inactive
	° 19A (3/14/85)/loose bolts	Note No. 2	Inactive

Notes:

1. Bechtel staff judged the deficient conditions to be acceptable. Calculations will be performed to confirm the staff's engineering judgement.
2. Bechtel staff viewed the deficient conditions as either being so severe or so minor that conclusions can be drawn without calculations.

TABLE 2

Summary of Train 1-2 Hanger Damage and Deficiency Evaluations

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
A3	65 (5/16/85)/gaps	A-3 (R1), 6/10/85	Acceptable for short-term use
49	° 19A (3/14/85)/ strut put out from wall	40A (C3), 3/25/85	Inactive
	° 60 (5/14/85)/gaps on new plate	40A-15, Rev. 2, 5/22/85	Acceptable
	° 91 (6/6/85)/gaps		Acceptable (Note No. 1)
50	° 19A (3/14/85) strut put out from wall	40A (C3), 3/25/85	Inactive
	° 91 (6/6/85)/gaps		Acceptable (Note No. 1)
51	° 44 (4/30/85)/gaps, bolts out of plumb	40A-25, Rev. 1, 5/20/85	Acceptable for short-term use
	° 52 (5/8/85)/ incorrect spring setting	40A-25, Rev. 1, 5/20/85	Will reset spring setting
	° 91 (6/6/85)/gaps		Acceptable (Note No. 1)
52	91 (6/6/85)/gaps		Acceptable (Note No. 1)
53/54	° 91 (6/6/85)/gaps		Acceptable (Note No. 1)
	° 43 (4/30/85)/ nonconforming weld	40A-13, Rev. 1, 5/9/85	Acceptable
55	91 (6/6/85)/gaps		Acceptable (Note No. 1)
56	91 (6/6/85)/gaps		Acceptable (Note No. 1)

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
58	32 (4/8/85)/frozen mechanical snubber	40B (C5), 5/1/85 and 40B (C9), 5/29/85	Modelled as rigid strut (Snubber was replaced on 4/24/85)
59	° 48 (5/8/85)/ snubber reservoir attached to A200	Note No. 2	Acceptable
	° 46 (5/2/85)/longer bolts	Note No. 2	Acceptable
60	58 (5/9/85)/ incorrect spring size	40B, Rev. 5 2/27/81	Acceptable for short-term use
62	68 (4/18/85)/loose strut	TECo review	Acceptable
136	42 (4/30/85)/ nonconforming bolts	40A-11, Rev. 1, 5/9/85	Acceptable
141	SR 85-74 (6/6/85)/ cracked concrete	TECo review	Acceptable
142	° 19A (3/14/85)/ strut put out from wall	40B (C5), 5/1/85 and 40B (C9), 5/29/85	Inactive
	° 66 (5/17/85)/gaps	D-40B-1, Rev. C, 5/24/85	Acceptable for short-term use
144	° 16 (3/1/85)/broken snubber	40B (C3), 3/21/85	Inactive
	° 38 (4/18/85)/ broken snubber	40B (C9), 5/29/85	Inactive
	° 66 (5/17/85)/gaps	40B-3, Rev. 0, 5/24/85	Acceptable

Hanger Nos.	NCR No. 85- / Description	Bechtel Calc. No.	Status
145	° 66 (5/17/85)/gaps	40B-2, Rev. 0, 5/24/85	Acceptable for short-term use Require flexibility check
	° 67 (6/12/85)/loose bolts	40B-2, Rev. 1, 6/17/85	Acceptable
147	° 16 (3/1/85)/strut put out from wall	40B (C3), 3/21/85 and 40B (C9), 5/29/85	Inactive
	° 66 (5/17/85)/gaps	40B-1, Rev. 1, 5/24/85	Acceptable
154	56 (5/9/85) / incorrect shim size	TECo review	Acceptable
A200	48 (5/8/85)/snubber reservoir attached to H59	Note No. 2	Acceptable
A362	90 (6/6/85)/gaps	Note No. 2	Acceptable

Notes:

1. Bechtel staff judged the deficient conditions to be acceptable. Calculations will be performed to confirm the staff's engineering judgement.
2. Bechtel staff viewed the deficient conditions as either being so severe or so minor that conclusions can be drawn without calculations.

The inspector stated that he would review the operability program and the results of Bechtel's evaluation of the collective analysis of the identified hanger damage during a future inspection. Subsequently, during discussions with TECo, the middle of September, 1985 was established as the completion date for these evaluations. This is considered an unresolved item (346/85013-05).

12. RIII Questions and Licensee Responses

The RIII questions and the licensee responses are as follows:

- a. What affect could dynamic transients have on the AFPTSS system?
Could it cause both trains to be inoperable at the same time?

The dynamic transient could have potential affect on both trains including (1) if both trains actuate and both trains sustain damage causing inoperability, and (2) if the first train is inoperable and then the second train is declared to be inoperable. The system inoperability could be caused by (1) unanalyzed pipe movements during system actuation, (2) damaged or broken components, and (3) loosened components. The deficient hardware conditions could result in (1) piping overstress, (2) pipe support overload, and (3) equipment nozzle loads that exceed the manufacturers' allowables.

- b. After each transient event, what corrective actions (controlled walkdown inspection, 50.59 evaluations, etc.) were taken?

January 1, 1985 through March 13, 1985 - Walkdowns of the AFPTSS piping system were not conducted after each actuation of the system following the completion of the fifth refueling outage ending in January 1985.

March 14, 1985 through May 7, 1985 - Initial support failures (H144, H147) were identified by QC on March 1, 1985. Subsequent support failures (A3, H34) were identified by QC on March 13, 1985. As a result of QC request, the site engineering staff conducted a walkdown on March 14-16, 1985 (not a controlled, proceduralized process) of the AFPTSS piping system to identify gross failures. Following the plant trip on March 21, 1985, the site engineering staff again conducted a similar walkdown to identify gross failures. For other actuations of the system through May 7, 1985, similar walkdowns were conducted after some of the system actuations, but not after all actuations. A Region III Confirmatory Action Letter 85-03 was issued on April 26, 1985. Train No. 1-1 of the AFPTSS piping system was not actuated between April 26, 1985 and May 23, 1985; Train No. 1-2 was not actuated between April 26, 1985 and May 13, 1985.

The controlled, proceduralized QC baseline walkdown inspection was conducted from May 8 through June 9, 1985, and after each actuation of the AFPTSS system during this period, with two exceptions, i.e., after the June 2 and June 9, 1985 plant trips. Following these two plant trips, the QC and site engineering staff performed walkdowns (these were not controlled, proceduralized processes) and found no gross failures. Prior to these two walkdown inspections, an operability verification test (ST5071.02) of the AFW system was performed.

Surveillance Reports (SRs) were used to document the deficiencies identified by QC and site engineering staff during walkdown inspections. These deficiencies were first evaluated and dispositioned by TECo engineering. Significant deficiencies were then documented in NCRs by QC. NCR dispositions including 10 CFR 50.59 and operability evaluations were conducted by Bechtel and TECo engineering.

- c. In view of the large number of damaged supports observed in the AFPTSS system, did piping stresses exceed FSAR commitments and/or the IE Bulletin 79-14 operability criteria?

Response will be provided when Bechtel completes its evaluation.

- d. If the answer to Item c is affirmative, were there instances where the piping overstress was in other than the seismic design conditions?

Response will be provided when Bechtel completes its evaluation.

- e. Were all of the damaged supports evaluated in a chronological order?

Depending on complexity and interrelationship with other occurring damaged supports, evaluations may not have been conducted in chronological order. Systematic evaluations for the conditions that existed before March 1, 1985, (when the problem was first identified) and up to June 9, 1985 will be performed by Bechtel Power Corporation.

- f. Were composite studies completed to evaluate all of the presently occurring transients?

Response will be provided when Bechtel completes its evaluation.

- g. After all the years of operation of this plant, why are these transient events just now occurring?

TECo does not know exactly if the transients occurred previously. It can reasonably be assumed that other transients may have occurred after January 1985 when opening of valves MS 106, 106A, 107, and 107A concurrently became a mode of system operation. This increased the amount of ambient piping subjected to hot steam flow and increased condensate accumulation inside the piping. The mixture of steam and condensate created flow turbulence and/or water hammer. There was also a possibility that the adverse hanger conditions could have been caused by a number of lesser transients that could have occurred prior to January 1985.

13. Licensee Report of Hanger Damages

The damage to the AFPTSS system hangers were reported to Region III by the licensee as follows:

- ° Letter to RIII (Log No. K85-649), dated April 19, 1985, transmitted LER No. 85007, "Auxiliary Feed Pump Turbine Response Time Problems." The LER stated, in part:

"In addition, a Steam and Feedwater Rupture Control System logic change also made during the 1984 Refueling Outage, was a possible cause of water flow forces in the main steam crossover supply lines which was loosening hangers and damaging supports."

"In addition, AFP 1-1 had been earlier declared inoperable on March 16, 1985, due to a hanger failure. At that time, the hanger problem was thought to be from water flow forces that resulted from the SFRCS logic change implemented during the 1984 Refueling Outage. The hanger was repaired the same day."

"Designation of Apparent Cause of Occurrence: The SFRCS logic change conducted under Facility Change Request 81-178, which opens the cross-connect main steam supply valves MS 106A and MS 107A, in addition to the main steam supply valves MS 106 and MS 107, on a full SFRCS trip has been determined to be a primary cause of the water flow forces. Water flow forces caused some hangers to loosen in both trains; however, an engineering evaluation determined that only one support on AFW Train 1 was damaged to the extent that it affected the operability of that train. That support was repaired the same day, and the train declared operable."

"Corrective Action...Change the logic of the steam supply valves (MS 106A and MS 107A) so that they will no longer open simultaneously with valves MS 106 and MS 107. This was done under FCR 81-178, Revision A, Supplement 2."

- o Letter to RIII (Log No. K85-934), dated June 27, 1985, transmitted LER No. 85007, Revision 1, same title. The LER stated, in part:

"Additionally, several days prior to the trip a visual inspection of the main steam supply lines to both Auxiliary Feed Pump Turbines identified loose hanger bolts and some hanger damage."

"The cause for loose hanger bolts and hanger damage has not been identified. Four different operating events have been postulated and continued investigation and testing is planned to identify the actual causes."

"All loose hanger bolts had been re-torqued and most of the damaged hangers had been either repaired or replaced prior to the trip. Plant procedures have been modified to minimize the transient loads placed on the steam piping due to system actuation and surveillance testing."

"In addition, AFP 1-1 had been declared inoperable on March 16, 1985, after the discovery of damage to the following hangers on the main steam piping to AFPT 1-1:

3A-EBD-19-H14
3A-EBD-19-H25
3A-EBD-19-H28
3A-EBD-19-H32
3A-EBD-19-H34
3A-HB5 19-H135

This was the second time since the beginning of the year that loose hanger bolts and damaged hangers had been discovered on the AFPT steam lines. Investigations initiated following the initial discovery of hanger damage had not yet identified the cause of the damage."

"An engineering evaluation of the hanger damage concluded that the damage to hanger 3A-EBD-19-H28 required AFP 1-1 to be declared inoperable. This hanger was repaired on March 17, 1985, allowing AFP 1-1 to be declared operable. Hangers 3A-EBD-19-H25 and 3A-EDB-19-H135 were determined to be operable in their as-found condition. The remaining hangers were restored to their as-built condition by March 23, 1985. An operability analysis for AFPT 1-1 assuming hangers 3A-EBD-19-H25, 3A-EBD-19-H28, and 3A-EBD-19-H135 operable with the other three hangers inoperable determined that the steam supply line for AFPT 1-1 met its short term operability requirements. A visual inspection of the AFPT steam lines after the March 21, 1985 trip and SFRCS actuation did not identify any new hanger damage."

"Since plant startup in January, 1985, after completion of the 1984 Refueling Outage, loose hanger bolts and damaged hangers have been discovered at several different locations in the main steam piping to the AFPTs. Additionally, damage to a single pipe anchor has been discovered. Although the exact cause of damage to piping hangers has not been identified, the following conditions are being investigated:

1. Use of auxiliary steam to perform testing of both AFPTs during the 1984 Refueling Outage.
2. Use of main steam and auxiliary steam to perform monthly surveillance test on pressure switches PSL106A-106D and PSL107A-107D which are located in the steam line to the AFPTs.
3. Opening of valves MS 106A and MS 107A simultaneously with MS 106 and MS 107 to supply main steam to AFPTs. Prior to the 1984 Refueling Outage only valves MS 106 and MS 107 were opened to supply main steam to AFPT 1-1 and AFPT 1-2.
4. Vibration from system actuation and monthly testing which over time loosen hanger bolts until they fail to perform their function during the transient event associated with quick starts of the system.

Additional testing and evaluations are expected to help determine the exact cause of the hanger problems."

"Both AFPT steam lines have been affected with hanger damage loose hanger bolts due to transients loads. Excluding the one damaged pipe anchor and the damage to hanger 3A-EBD-19-H28, analysis has shown that the hanger damage discovered to date has not affected the short-term operability of the piping system."

"Corrective Action...

2. Change the logic for steam supply valves MS 106A and MS 107A so that they will no longer open simultaneously with valves MS 106 and MS 107.
3. Revise the surveillance test for PSL106A-106D and PSL107A-107D so as to perform the test without use of either main steam or auxiliary steam.
4. Instruct operator to slowly open the supply valve from the auxiliary steam system using auxiliary steam to test AFW pumps.
5. Replace and/or repair damaged hangers and re-torque all loose bolts.

A test plan is being prepared to perform a systematic test of the steam lines to the AFPTs under Facility Change Request 85-0087. Through this test program the transient loads experienced by the steam line due to system actuation will be measured on selected hangers along with the transient pressurization of the steam lines and the piping temperatures. The test program will assist in quantifying the loads experienced due to the initial pressurization and heatup of the cold steam lines. Also, it will help identify the major causes of hanger damage. Until the cause of the hanger damage is identified and corrected, the steam line hangers will be inspected after every initiation of the system including monthly and quarterly surveillance testing."

At the conclusion of the inspection, the inspector's review determined that the licensee failed to report the system adverse conditions in accordance with the requirements of 10 CFR 50.73.a(1), (2)ii(A), and (2)ii(B) as follows:

- a. The April 19, 1985, the LER discussed damage to one hanger (H 28) and "some hangers to loosen in both trains." The other specific damage as described in Paragraph 3 and listed below were not reported:

Train No. 1-1

H 132
H 34
H 32
H 25
H 14
H 135
H 66

Train No. 1-2

H 50
H 49
A 3
H 142
H 28
H 144
H 147

- b. The June 27, 1985, the LER reported the following hanger damage:

Train No. 1-1

H 28
H 14
H 25
H 28
H 32
H 34
H 135

The other hanger damage (listed below) was not reported (refer to Paragraphs 3, 7, and 8):

Train No. 1-1

H 132
H 66
H 133
H 10
H 67
EBD-20-H1
H 13
H 13A
H 15
H 16
H 33
H 20

Train No. 1-2

H 50
H 49
A 3
H 142
H 28
H 144
H 147
H 142
H 145
H 62

- c. Gaps found behind baseplates on the following hangers (refer to Paragraph 11) were not reported:

Train No. 1-1

H 135
H 21
H 22
H 23
H 24
H 133
H 132
H 6
H 8
H 9
H 10
H 12
H 26
H 65
H 66
H 67
H 68
H 72
H 74
H 131

Train No. 1-2

H 51
H 52
H 53
H 54
H 55
H 56
H 144
H 145
A 3

Train No. 1-1

H 148
H 150
A 362

- d. Damage observed on the following hangers on the auxiliary feedwater pump discharge lines was not reported (refer to Paragraph 9):

6C-EB-14-H 87, 76, 80, 90, 54, 69, 68, 67, 77, and 91.

There are 53 hangers on AFPTSS Train 1-1 of which 19 were found damaged. There are 27 hangers on AFPTSS Train 1-2 of which 10 were found damaged. The inspector considers the damage to be substantial and that they should have been reported to the NRC in a more complete manner in accordance with 10 CFR 50.73 requirements. The condensate in the AFPTSS piping created a flow turbulence (dynamic transient) that led to excessive piping movement and caused damage to the piping supports. The condensate flashing to steam in the turbine could cause turbine overspeeding and pump trip. The use of the IE Bulletins 79-02 and 79-14 operability criteria in lieu of FSAR design commitment to allow continued system operation for a short duration prior to restoration of the support component to the original design conditions is acceptable. However, the licensee is responsible for reporting all significant degradation of systems and unanalyzed conditions that deviate from the FSAR commitments regardless of whether or not the as-found system met or exceeded the IEB Bulletin operability criteria.

This is a violation of 10 CFR 50.73 reporting requirements. (346/85013-06).

14. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, violations, or deviations. Unresolved items disclosed during this inspection are discussed in Paragraphs 9 and 11.

15. Exit Interview

Exit interviews with licensee representatives were conducted on July 11 and August 2, 1985, to discuss the inspector's findings. The inspector discussed the likely informational content of the inspection report with regard to documents reviewed by the inspector during the inspection. The licensee did not identify any such documents as proprietary.



CONFIRMATORY ACTION LETTER
UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
99 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

RII1-CAL-85-03

Attachment 1

APR 26 1985

Docket No. 50-346

Toledo Edison Company
ATTN: Mr. Richard P. Crouse
Vice President
Nuclear
Edison Plaza
300 Madison Avenue
Toledo, OH 43652

Gentlemen:

This refers to the discussion between Mr. J. Wood of your staff and Mr. D. Danielson of my staff on April 26, 1985, regarding activities you will take as a result of the damage recently sustained by several auxiliary steam supply feed pump turbine (AFPTSS) piping restraints on Davis-Besse Unit 1. With regard to the matters discussed, we understand you will take the following actions:

1. Complete by May 10, 1985, piping system operability stress analyses local to the following damaged restraints utilizing loads calculated to have been necessary to cause the degraded conditions of the restraints:
 - ° AFPTSS Train No. 1-1: 3A-EBD-19-H144
3A-EBD-19-H145
 - ° AFPTSS Train No. 1-2: 3A-EBD-19-H14
3A-EBD-19-H58

The maximum piping transient stress (St) will be combined with applicable primary pipe stresses utilizing the following formula:

$$Sp + Sw + \sqrt{Se^2 + St^2} \leq 2.4 Sh$$

Where

- Sp = pressure stress at operating condition
- Sw = stress due to piping and attachment dead weights
- Se = stress calculated based on plant safe shutdown earthquake (SSE) condition
- Sh = ANSI B31.1 pipe stress allowable for hot operating condition

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2. Complete by May 24, 1985, torque tests for concrete expansion anchor bolts installed on all snubbers and rigid supports and restraints shown on the following drawings:
 - ° HL-203F, "Main Steam System, Supply to Auxiliary Feed Pump Turbine No. 1-1", Revision 0.
 - ° HL-203H, "Main Steam System, Supply to Auxiliary Feed Pump Turbine No. 1-2 and Exhaust", Revision 1.
3. Initiate by June 5, 1985 an inservice testing program for the AFPTSS piping system to determine the cause and nature of the system transient that resulted in the degradation of the restraints identified during previous inspections by Toledo Edison Company (TECo). The program will include load and displacement measurements under cold and hot operating conditions for the following piping alignments:
 - ° Steam supply to auxiliary feed pump turbine (AFPT) No. 1-1 from Steam Generator (SG) No. 1-1.
 - ° Steam supply to AFPT No. 1-2 from SG No. 1-2.
 - ° Steam supply to AFPT No. 1-1 from SG No. 1-2 through crossover leg.
 - ° Steam supply to AFPT No. 1-2 from SG No. 1-1 through crossover leg.

Prior to initiation of the program, TECo will:

- a. Develop test procedures including identification of instrumentation locations on isometric drawings and delineation of personnel interface and responsibilities during the tests.
- b. Implement calibration procedures for all instrumentation including the strain gauges installed on snubbers and rigid restraints.
- c. Establish evaluation criteria for load and displacement measurements based on the calculated SSE values.

An inservice test that requires steam flow to AFPT Nos. 1-1 and 1-2 from SG Nos. 1-1 and 1-2 utilizing both main and crossover legs will not be conducted until previous tests performed under this program have been evaluated, necessary precautionary measures have been established, and test provisions and measures have been reviewed by Region III.

4. Conduct piping system surveillance during the monthly auxiliary feed pump tests and the quarterly system response tests performed under normal plant operating conditions and during testing conducted as a result of plant shutdowns or maintenance activities.

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5. Report to Region III verbally within 2 working days, with a followup written report within 72 hours, any defective structures and piping suspension system components discovered during the activities described in Items 1 through 4 above or following any actuation of the auxiliary feedwater system. Such reports will not relieve TECo of the obligation to submit any reports required by 10 CFR 50.72.

Please inform us immediately if your understanding of these actions are different from that stated above.

Charles E. Novak
for James G. Keppler
Regional Administrator

cc: S. Quennoz, Station
Superintendent
DMB/Document Control Desk (RIDS)
Resident Inspector, RIII
Harold W. Kohn, Ohio EPA
James W. Harris, State of Ohio
Robert H. Quillin, Ohio
Department of Health
R. Baer, IE
F. Cherney, MEB, NRR