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

April 9, 1981

Docket No. 50-339

MEMORANDUM FOR: T. M. Novak, Assistant Director
for Operating Reactors
Division of Licensing

THRU: Robert A. Clark, Chief
Operating Reactors Branch #3
Divison of Licensing

FROM: Leon Engle, Project Manager
Operating Reactors Branch #3
Division of Licensing

SUBJECT: SUMMARY OF MEETING WITH ELECTRIC POWER RESEARCH INSTITUTE, WESTINGHOUSE CORPORATION, DUKE POWER COMPANY, AND THE VIRGINIA ELECTRIC AND POWER COMPANY REGARDING THE TESTING OF BLOCK VALVES.

A meeting was held in Bethesda, Maryland on March 20, 1981 regarding the subject as noted above. A list of attendees is provided in Attachment No. 1.

Introduction:

Full scale qualification testing of Power Operated Relief Valves (PORV) is specified in NUREG-0737 "Clarification of TMI Action Plan Requirements". The testing of the PORV is to be completed by July 1, 1981.

The requirement for full-scale qualification testing of PORV block valves is to be completed by July 1, 1982. This requirement was first formally indentified in Item II.D.1 of NUREG-0737. The purpose of the block valve testing is to provide empirical evidence that block valves located between the pressurizer and each PORV can be operated, closed and opened for fluid conditions expected under operating and accident conditions.

By letter dated December 15, 1980, the PWR Owners Group notified the NRC that it would not commit to implement a block valve test program until the PORV test program, due July 1, 1981, had been completed. Since then, discussions between the NRC staff and the Owners Group have resulted in a verbal commitment from the Group for the establishment of a block valve test program. The completion date for this test program is July 1, 1982. It is presently anticipated that the Owners Group will be submitting a block valve test program to the NRC in May, 1981.

Anticipating the requirement for a formalized block valve testing program, the Electric Power Research Institute (EPRI) made provisions at the Marshall Test Facility for the installation of block valves between the facility steam source and the PORV's. Since no formal block valve test program was in place, EPRI obtained seven different block valves which were tested in July, 1981 in order to provide base-line data on block valve closure.

As a result of this testing, EPRI notified the NRC that three of the valves tested would not fully close under test conditions. Two of three affected valves were manufactured by the Westinghouse Corporation (W). The third valve was manufactured by Anchor/Darling and was subsequently modified by the manufacturer and successfully retested. W sent advisory letters on the 3 inch gate valve in question to its NSSS customers in late October-early November, 1980 and additional advisory letters on the 3 and 4 inch gate valves to its NSSS customers on February 12, 1981.

Two utilities which had installed the W valves in question were Duke Power Company (Oconee Units - B&W NSSS) and the Virginia Electric and Power Company (North Anna and Surry Units-W NSSS).

A meeting notice was issued by the NRC on March 18, 1981, requesting that EPRI, W, Duke Power and VEPCO convene with the NRC staff on March 20, 1981 to discuss these matters so that the chronological order of events and the reporting requirements of 10 CFR Part 21 and 10 CFR Part 50.55(e) could be placed in proper perspective. The agenda for the meeting was specified in the NRC notice (See Attachment 2) and the results of the March 20, 1981 meeting are summarized below.

1. Discussion of Block Valve Testing at Marshall Steam Station

EPRI provided the details of its PWR safety and relief valve test program. The formation of the test program, the table of organization for the test program, and program output is provided in Attachment #3.

As mentioned previously, EPRI anticipated new forthcoming requirements for a block valve test program to be completed by July 1, 1982. In order to obtain baseline data for use in evaluating and preparing a block valve test program responsive to NUREG-0737, EPRI tested seven easily obtainable block valves. At the time that the block valves were tested, EPRI did not have access to information regarding the number of nuclear facilities which might have any of the block valves either installed or planned to be installed.

The seven block valves tested were Anchor/Darling; Borg Warner; Rockwell; Velan, Model C 2345 SN-243402; Velan, Model B10-3054 B013M (MO); Westinghouse Model 3GM88 and Westinghouse Model 3GM99. Initial test indicated that three of the block valves would not fully close against full flow (saturated steam at about 2400 pounds per square inch differential). The three valves in question were the W Model 3GM88 and Model 3GM99 valves and the Anchor/Darling

valve. The Anchor/Darling valve was modified and successfully retested. In general the valve failures were caused by too low of a torque capability on the valve operator.

The EPRI staff involved in the block valve tests notified the EPRI Safety and Relief Valve Subcommittee and W. The EPRI Subcommitee Chairman then notified the NRC staff who in turn contacted the EPRI staff for additional information. Also, as part of the EPRI test program, a valve manufucturer's representative is required on-site during valve testing and the subsequent disassembly and inspection of a tested valve.

No violations of 10 CFR Part 21 are applicable regarding EPRI's obligation for reporting requirements. The block valve tests were performed with a valve vendor present and the test results were transmitted to the valve vendors. Also, EPRI was neither under contract with vendors nor users and was not aware of specific valve application at facilities either in operation or under construction.

2. Discussion of Westinghouse Water Test on 3 and 4 Inch Gate Valves

W provided a discussion of recent water valve tests on 3 and 4 inch valves and provided specific data regarding the W valve Models 3GM88 and 3GM99. W also provided its solution to the 3 and 4 inch gate valve closure problem based on the Marshall Test Facility results and the water test conducted on the gate valves. The salient points of this discussion are provided in Attachment No. 4.

33. Discussion of Westinghouse letters to Licensees Regarding Valve Testing

W provided a time chronology of its actions from the time it was notified of the Marshall test results on July 9, 1980 regarding the W valve 3GM88. From July to early September, 1980, Westinghouse investigated block valve availability for NSSS application and evaluated test results for resolution of valve performance.

On September 16, 1980, the W Safety Review Committee (WSRC) convened to assess block valve failure to completely close at rated torque values. The WSRC determined that the W Safety Analysis Report for the worst case small hot leg break enveloped a stuck open PORV event, and that the WCAP-9600 Report showed no core uncovery assuming all PORVs stuck open (no block valves). The WSRC determined that the present status of the W valves in question was neither a substantial hazard pursuant to 10 CFR Part 21, nor a significant deficiency under 10 CFR Part 50.55(e). At the same time, the WSRC decided to expand its investigations to other 3 and 4 inch gate valve applications.

On September 25,1980, W advised the NRC by telephone of the block valve issue. And, during September, 1980, W was advised of the failure of certain 3 inch gate valves to close at two facilities which were undergoing pre-operational testing.

On October 28, 1980, the WSRC again convened to discuss 3 inch gate valves and NSSS customers were notified of a potential violation of 10 CFR 50.55(e). On October 30, 1980, W informally notified the NRC on the 3 inch gate valve deficiency. On November 18-20, 1980, the NRC conducted an audit at W, and included in the NRC audit was the September 16, 1980 WSRC findings for determining that the valve issue was not reportable under 10 CFR Part 21 or 10 CFR Part 50.55(e).

During the month of December, 1980, W laboratory water tests were conducted on 3 and 4 inch gate valves. In January, 1981, W was notified of Marshall test results for W valve 3GM99, and on January 15, 1981 W provided the NRC with an update on the issue of 3 and 4 inch gate valve deficiency.

The NRC conducted an additional audit at W on February 5, 1981. And, on February 10, 1981 the WSRC committee met once again to discuss W valve 3GM99 and other 4 inch gate valve applications. And finally, W notified its NSSS customers within 24 hours of the WSRC meeting regarding a potential violation of 10 CFR Part 50.55(e) (See Attachment No. 5).

4. Duke Review of Westinghouse Letters and Actions Taken on Oconee Units

Duke Power (the licensee) received two W advisory letters on October 27, 1980 and November 1, 1980 regarding the 3 inch gate valves. The licensee determined that three of the valves discussed in the W letters had been installed as PORV block valves on Oconee Units 1, 2 and 3 (See Attachment No. 6).

On November 17, 1980 the licensee performed a safety evaluation in accordance with the requirements of 10 CFR Part 21 and concluded there were no unanalyzed safety problems because, (1) the Oconee units had been analyzed for safe shutdown capability with a stuck open PORV, (2) plant modifications had been made for NRC requirements addressing the TMI-2 accident, and (3) the licensee's confidence that the demands for actuation of a PORV in response to plant transients had been substantially reduced on all three Oconee units. The licensee's confidence regarding PORV actuation is substantiated by plant operations during 1980 when there were no PORV actuations. At the time of the licensee's determination regarding 10 CFR Part 21, Oconee Unit 2 was shutdown and Oconee Units 1 and 3 were operating.

Prior to restart for Oconee, Unit 2, the licensee made an adjustment in the torque switch setting on the Unit 2 block valve. This torque switch setting increased the valve closure force on the Unit 2 block valve. Oconee, Unit 3 was shutdown for refueling in December, 1980 and during this outage, modifications recommended by W were implemented. These modifications included changes in the block valve operator control switch and operator gearing. These same modifications were made shortly thereafter on Oconee, Unit 2 when it was again shutdown in December, 1980. For Oconee, Unit 1, the licensee

determined that the Unit 1 block valve would be modified at the first extended Unit 1 outage. In the meantime, the licensee closed the Unit 1 block valve in February, 1980. Closure of this block valve is permissible by the plant Technical Specificaitons. Also, the Office of Inspection & Enforcement verified the actions described by the licensee through the resident I&E inspector.

5. VEPCO Discussion of Westinghouse Letters and Actions Taken on North Anna Units

The Virginia Electric and Power Company (the licensee) received the Westinghouse advisory letters in the same time period as Duke Power. (These two letters and additional correspondence are provided in Attachment No. 7.).

The licensee made a search of its files to determine whether any of the W block valves in question were installed at either the North Anna or Surry Units. It was determined that one of the W valves had been installed as a PORV block valve at North Anna, Unit 2. It should be noted that the North Anna design has two PORV's and two block valves per unit.

Once the licensee had determined a W block valve was in place at North Anna, Unit 2, the licensee's Safety Review Committee met on March 5, 1981 and determined that the lack of block valve closure capability was not reportable as a safety issue for either 10 CFR Part 21 or 10 CF Part 50.55(e). This determination by the licensee was based on the recently NRC approved Westinghouse analysis, which demonstrated that the North Anna Units could be safely shutdown with one or both PORV's stuck open.

The licensee decided to continue full power operations at North Anna, Unit 2 with both block valves open and to install the W recommended valve modifications at a maintenance outage scheduled for May 1981. Also, the North Anna, Unit 2 reactor operators were cautioned that under certain flow conditions the W block valve might not fully close. In addition, the I&E resident inspector was kept informed of these decisions and has verified that the reactor operators have been alerted to the block valve closure deficiency.

Conclusion:

The Office of Inspection and Enforcement is in the process of verifying that no other applications of the unmodified W valves in question are installed or planned for installation at nuclear facilities. An I&E generic letter will be issued in the near future to all licensee and applicants regarding this matter.

Leon B. Engle, Project Manager
Operating Reactors Branch #3
Divison of Licensing

Attachemnts:
No. 1
No. 2
No. 3
No. 4
No. 5
No. 6
No. 7

cc: See next page

MEETING SUMMARY DISTRIBUTION

Licensee: Virginia Electric and Power Company

*Copies also sent to those people on service (cc) list for subject plant(s).

Docket File
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ECase
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Virginia Electric and Power Company

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U.S. Environmental Protection Agency
Washington, D. C. 20460

U.S. Environmental Protection Agency
Region III Office
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Atomic Safety and Licensing
Appeal Board Panel
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Commonwealth of Virginia
Council of the Environment
903 Ninth Street Office Building
Richmond, Virginia 23129

ATTACHMENT 1

LIST OF ATTENDEES

MEETING ON

MARCH 20, 1981

NUCLEAR REGULATORY COMMISSION

OCM
L. Marsh (TA to Bradford)

ACRS
D. Bessette

STAFF
R. Bosnak
E. Brown
F. Cherny
R. Clark
L. Engle
B. Forrest
H. Gregg
J. Knight
W. Jensen
E. Hemminger
C. Hofmayer
G. Holahan
E. Jordan
R. LaGrange
H. Levin
J. Mazetis
T. Novak
H. Ornstein
R. Riggs
Z. Rostoczy
M. Stolzenberg
P. Wagner

NUCLEAR SAFETY OVERSIGHT COMMITTEE
J. Stampelos

UNION OF CONCERNED SCEINTISTS
S. Sholly

ELECTRIC POWER RESEARCH INSTITUTE
T. Amble
J. Carey

WESTINGHOUSE CORPORATION
J. Drake
C. Gottshall
D. Kitch
W. Maelaurin
D. Rawlins

DUKE POWER COMPANY
R. Gill
S. Hart
A. West

VIRGINIA ELECTRIC AND POWER COMPANY
E. Smith
B. Sylvia

CONSUMER POWER COMPANY
D. Hoffman

PACIFIC GAS & ELECTRIC COMPANY
G. Wu

EG&G (Idaho)
J. Hunter

INTERMOUNTAIN TECHNOLOGY, INCORPORATED
S. Kucharski

ATTACHMENT 2

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

MAR 1 - 1981

Docket No. 50-338

MEMORANDUM FOR: Robert A. Clark, Chief
Operating Reacotrs Branch #3, DL

FROM: Leon B. Engle, Project Manager
Operating Reactors Branch #3, DL

SUBJECT: FORTHCOMING MEETING WITH DUKE POWER COMPANY, VIRGINIA ELECTRIC AND POWER COMPANY, ELECTRIC POWER RESEARCH INSTITUTE, AND WESTINGHOUSE CORP.

Date & Time: March 20, 1981
1:00 PM, Friday

Location: Room P-422, Phillips Building
Bethesda, Maryland

Purpose: To discuss and review block valve testing.

Participants:

NRC
T. Novak
J. Knight
T. Jordan
R. Bosnak
P. Check
R. Clark
J. Stolz
G. Schwenk
P. Wagner
[redacted] Engle
F. Cherny

VEPCO
R. Sylvia
D. Spiedel
G. Smith
W. Harrel

DUKE POWER
R. Gill

EPRI
J. J. Carey, et al.

WESTINGHOUSE
(To be announced at meeting)

Attachment:
Meeting Agenda

cc: See back of page

Leon B. Engle, Project Manager
Operating Reactors Branch #3
Division of Licensing

ATTACHMENT

MEETING AGENDA

1. Discussion of Block Valve Testing at Marshall Steam Station.
2. Discussion of Westinghouse Water Test on 3 and 4 inch gate valves.
3. Discussion of Westinghouse Letter to all Licensees regarding valve testing.
4. Duke review of Westing house letter and actions taken on Oconee Units.
5. VEPCO discussion of Westinghouse letter and actions taken on North Anna Units.

ATTACHMENT 3

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

NRC MEETING

MARCH 20, 1981

BETHESDA, MARYLAND

JOHN CAREY

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

PROGRAM OBJECTIVE:

OBTAIN FULL SCALE DATA ON THE OPERATIONAL PERFORMANCE OF PRESSURIZED WATER REACTOR PRIMARY SYSTEM RELIEF AND SAFETY VALVES UNDER EXPECTED OPERATING CONDITIONS FOR DESIGN-BASIS TRANSIENTS AND ACCIDENTS BY JULY 1, 1981

UTILIZATION OF PROGRAM DATA:

LICENSEES AND APPLICANTS WILL UTILIZE DATA TO SUPPORT PLANT-SPECIFIC SUBMITTALS IN RESPONSE TO SAFETY AND RELIEF VALVE TEST REQUIREMENTS IDENTIFIED IN NUREG 0737, ITEM II.D.1

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

- PROGRAM INITIATED IN SEPTEMBER, 1979 BY EPRI NUCLEAR POWER DIVISION AT THE REQUEST OF THE TMI AD HOC NUCLEAR OVERSIGHT COMMITTEE

- PROGRAM PLAN DEVELOPED AND SUBMITTED BY UTILITIES TO NRC ON DECEMBER 17, 1979 (REVISION 1 SUBMITTED ON JULY 8, 1980)

- SEPARATE PROGRAMMATIC ACTIVITY WITHIN EPRI SAFETY AND ANALYSIS DEPARTMENT

- UTILITY ADVISORY GROUPS:

  EPRI-RAC-NSAC SUBCOMMITTEE

  SAFETY AND ANALYSIS DEPARTMENT TASK FORCE

  SAFETY AND RELIEF VALVE SUBCOMMITTEE

  TECHNICAL ADVISORY GROUP

  QUALITY ASSURANCE ADVISORY COMMITTEE

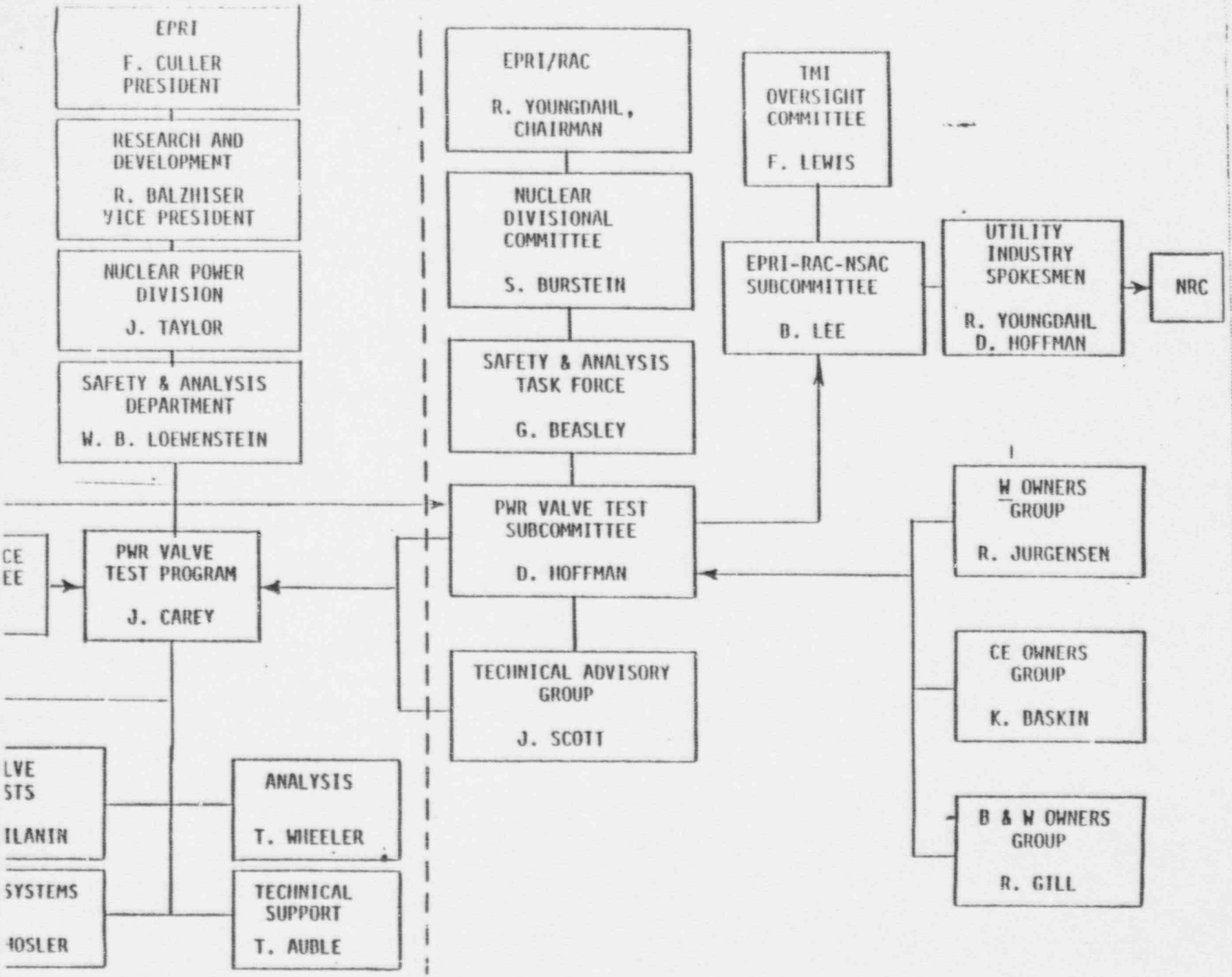
SAFETY AND RELIEF VALVE SUBCOMMITTEE

DAVID HOFFMAN, CHAIRMAN	(CONSUMERS POWER CO.)
ROGER NEWTON	(WISCONSIN ELECTRIC POWER)
JOSEPH TURNAGE	(YANKEE ATOMIC)
JAMES SCOTT	(PUBLIC SERVICE ELECTRIC & GAS OF NEW JERSEY)

TECHNICAL ADVISORY GROUP

JAMES SCOTT, CHAIRMAN	(PUBLIC SERVICE ELECTRIC & GAS OF NEW JERSEY)
KENNETH BERRY	(DUKE POWER CO.)
TERRELL CLIFT	(TENNESSEE VALLEY AUTHORITY)
WILLIAM JONES	(YANKEE ATOMIC)

TECHNICAL, LICENSING, AND EXECUTIVE CONTACTS FOR EACH PARTICIPATING PWR UTILITY



EPRI/UTILITY ORGANIZATIONAL STRUCTURE

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

UTILIZES THREE TEST FACILITIES TO COMPLETE ALL REQUIRED TESTS BY PRESCRIBED DATE OF JULY 1, 1981

1. MARSHALL STEAM STATION (DUKE POWER) RELIEF VALVE TEST FACILITY

   RELIEF VALVE STEAM TESTS

2. EPRI/WYLE RELIEF VALVE TEST FACILITY

   RELIEF VALVE SUBCOOLED WATER TESTS

3. EPRI/CE SAFETY AND RELIEF VALVE TEST FACILITY

   - SAFETY VALVE TESTS; STEAM, SUBCOOLED WATER AND STEAM TO WATER TRANSITION
   - SAFETY/RELIEF VALVE DISCHARGE PIPING LOAD DATA

RELIEF AND SAFETY VALVE TESTS

- PERFORMANCE SCREENING CRITERIA DEVELOPED
  (NRC NOTIFIED OF CRITERIA FOR RELIEF VALVES)

- PROCEDURE ESTABLISHED FOR DISSEMINATING TEST DATA
  (REVIEWED BY NRC)

- VALVE MANUFACTURER'S REPRESENTATIVE AT TEST SITE DURING TEST AND SUBSEQUENT DISASSEMBLY OF VALVE

- QUICK LOOK DATA SHEETS DISTRIBUTED TO AFFECTED UTILITIES, NSSS VENDOR, VALVE MANUFACTURER

PROGRAM DOCUMENTS

1. PROGRAM PLAN FOR THE PERFORMANCE TESTING OF PWR SAFETY AND RELIEF VALVES, REVISION 1, JULY 1, 1980

2. PWR SAFETY AND RELIEF VALVE TEST PROGRAM, DESCRIPTION AND STATUS, FEBRUARY 1981 (ISSUED APPROXIMATELY EVERY SIX WEEKS)

3. WEEKLY TEST ACTIVITY REPORTS

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

FOUR PRINCIPAL PROGRAM OUTPUTS:

1. TEST REPORTS FROM THE MARSHALL, WYLE AND CE VALVE TEST PROGRAMS

2. A REPORT DOCUMENTING THE SELECTION OF THE RELIEF AND SAFETY VALVES TO BE TESTED AND JUSTIFYING THE APPLICABILITY OF THE TEST RESULTS TO VALVES UTILIZED IN OPERATING PLANTS AND PLANTS UNDER CONSTRUCTION

3. A REPORT PROVIDING JUSTIFICATION OF THE SET OF GENERICALLY LIMITING FLUID CONDITIONS UTILIZED TO ESTABLISH THE VALVE TEST CONDITIONS

4. A REPORT DOCUMENTING A CODE FOR COMPUTING HYDRODYNAMIC LOADS FOR RELIEF AND SAFETY VALVE DISCHARGE PIPING UNDER STEAM AND WATER DISCHARGE CONDITIONS

EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

PROGRAM COST: SEPTEMBER, 1979 - DECEMBER, 1981

~ APPROXIMATELY $18,000,000.

PROGRAM FUNDING:

- 41 PARTICIPATING PWR UTILITIES
- EPRI/NSAC

PWR BLOCK VALVE TESTS

- BLOCK VALVE TESTS NOT INCLUDED IN NUREG 0578 RECOMMENDATIONS (JULY, 1979)

- BLOCK VALVE TEST PROGRAM CURRENTLY NOT A FORMAL PART OF EPRI PWR SAFETY AND RELIEF VALVE TEST PROGRAM

- BLOCK VALVE TEST REQUIREMENTS IDENTIFIED IN NUREG 0660, MAY, 1980 AND FURTHER CLARIFIED IN NUREG 0737, NOV., 1980:
  - VERIFICATION OF BLOCK VALVE FUNCTIONABILITY
  - TESTS TO BE COMPLETE BY JULY 1, 1982
  - LICENSEE TO PROVIDE EVIDENCE SUPPORTED BY TEST THAT BLOCK VALVE CAN BE OPERATED, CLOSED AND OPENED FOR ALL FLUID CONDITIONS EXPECTED UNDER OPERATING AND ACCIDENT CONDITIONS

- PWR UTILITIES HAVE REQUESTED EPRI TO PREPARE A BLOCK VALVE TEST PROGRAM RESPONSIVE TO THE REQUIREMENTS OF NUREG 0737

- EPRI IS DEVELOPING A BLOCK VALVE TEST PROGRAM PLAN FOR SUBMITTAL TO PWR UTILITIES BY JUNE 1, 1981

PWR BLOCK VALVE TESTS

EPRI BLOCK VALVE TESTS AT MARSHALL STEAM STATION

- MARSHALL STEAM STATION TEST LOOP ORIGINALLY (1978-79) SET-UP BY DUKE POWER FOR RELIEF VALVE TESTS

- MARSHALL TEST LOOP INCLUDES PROVISION FOR RELIEF AND BLOCK VALVES

- EPRI CONTRACTED WITH DUKE POWER (EARLY 1980) FOR UTILIZATION OF THE TEST FACILITY TO PERFORM STEAM TESTS ON POWER OPERATED RELIEF VALVES AS PART OF THE EPRI PWR VALVE TEST PROGRAM IN RESPONSE TO NUREG 0578

- IN LIGHT OF THE NEW REQUIREMENT FOR BLOCK VALVE TESTS (NUREG 0660), EPRI RECOMMENDED LIMITED BLOCK VALVE TESTS AT MARSHALL WHICH WOULD NOT INTERFERE WITH THE PRIMARY OBJECTIVE OF RELIEF VALVE TESTS AS REQUIRED BY NUREG 0578

- UTILITY ADVISORY GROUP APPROVED RECOMMENDATION AND NRC WAS NOTIFIED OF PLANS TO TEST A LIMITED NUMBER OF BLOCK VALVES AT MARSHALL

MARSHALL BLOCK VALVE TESTS

- SEVEN BLOCK VALVES TESTED

  ANCHOR/DARLING
  BORG WARNER
  ROCKWELL
  VELAN, MODEL C2345 S/N-243402
  VELAN, MODEL B10-3054B013M (MO)
  WESTINGHOUSE, MODEL 3GM88
  WESTINGHOUSE, MODEL 3GM99

- VALVE MANUFACTURER TECHNICAL REPRESENTATIVE ON SITE DURING EPRI BLOCK VALVE TEST (EXCEPT FOR FIRST TEST OF WESTINGHOUSE MODEL 3GM99 ON JANUARY 12, 1981)

- CHAIRMAN, SAFETY AND RELIEF VALVE SUBCOMMITTEE NOTIFIED OF BLOCK VALVE TEST RESULTS

- INITIAL TESTS OF THREE BLOCK VALVES INDICATED AN INABILITY TO FULLY CLOSE AGAINST FULL FLOW (SATUPATED STEAM, ~2400 PSI)

  ANCHOR/DARLING ✓
  WESTINGHOUSE MODEL 3GM88 ✓
  WESTINGHOUSE MODEL 3GM99 ✓

- EPRI STAFF NOTIFIED:

  SUBCOMMITTEE CHAIRMAN
  WESTINGHOUSE ✓

MARSHALL BLOCK VALVE TESTS

- SUBCOMMITTEE CHAIRMAN NOTIFIED NRC

- NRC CONTACTED EPRI STAFF AND WERE PROVIDED WITH ADDITIONAL INFORMATION

- MARSHALL BLOCK VALVE TEST REPORTS IN PREPARATION; FIRST DRAFT OF EACH BLOCK VALVE TEST REPORT WILL BE SUBMITTED TO ALL PWR UTILITIES AS THEY BECOME AVAILABLE. ALL SEVEN REPORTS WILL BE COMPLETED AND SENT TO UTILITIES ON OR BEFORE MAY 1, 1981

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

1. ANCHOR DARLING

- INITIAL TEST, AUGUST 15, 1980
- BLOCK VALVE IN-LINE WITH FISHER PORV
- BLOCK VALVE WOULD NOT FULLY CLOSE AGAINST FULL FLOW (70% CLOSED)
- DISASSEMBLY INDICATED SOME SIGNIFICANT WEAR PATTERNS AT THE DISC/SEAT INTERFACE
- VALVE RETURNED TO MANUFACTURER FOR MODIFICATIONS
- VALVE WAS RETURNED TO MARSHALL FOR FURTHER TESTS
- VALVE WAS RETESTED ON SEPTEMBER 25, 1980 IN LINE WITH FISHER PORV, AND UTILIZED A ROTORK 16NAX1 OPERATOR .
- VALVE WAS CYCLED 21 TIMES AGAINST FULL FLOW (SATURATED STEAM, ~2400 PSI, ~195,000 LBM/HR) WITH NO SIGNIFICANT ANOMALIES NOTED. SEAT LEAKAGE AFTER TEST RANGED FROM 0.019 TO 0.066 GPM
- ANCHOR DARLING PERSUING ADDITIONAL MODIFICATIONS TO FURTHER REDUCE SEAT LEAKAGE

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

2. BORG WARNER

- TESTED IN LINE WITH M.SONEILAN PORV ON NOVEMBER 4, 1980. VALVE ACTUATED WITH A ROTORK OPERATOR

- CYCLED (OPENED/CLOSED) AGAINST FULL FLOW (~210,000 LBM/HR) WITH NO ANOMALIES NOTED

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

3. ROCKWELL

- INITIAL TEST (PRESSURIZATION OF LOOP) UNCOVERED A BODY TO BONNET SEAL PROBLEM; DESIGN WAS MODIFIED AND TESTED ON OCTOBER 27, 1980

- VALVE IN LINE WITH COPES VULCAN PORV AND CYCLED 21 TIMES AGAINST A FULL FLOW OF ~230,000 LBM/HR. VALVE WAS ACTUATED WITH A LIMITORQUE OPERATOR MODEL SMB-00-10

- NO ANOMALIES WERE NOTED. SEAT LEAKAGE WAS 0.0 GPM

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

4. VELAN, MODEL C2345 S/N-24302

- VALVE WAS EQUIPPED WITH LIMITORQUE ACTUATOR MODEL NO. SMB-00-15

- VALVE WAS CYCLED 21 TIMES AGAINST A FULL FLOW OF ~246,000 LBM/HR ON JANUARY 13, 1981

- SEAT LEAKAGE WAS 0.0 GPM

- SOME GALLING INDICATIONS ON ONE OF THE DISC GUIDES WAS OBSERVED WHEN THE VALVE WAS DISASSEMBLED AND INSPECTED

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

5. VELAN, MODEL B10-3054B013M (MO)

- VALVE WAS EQUIPPED WITH LIMITORQUE OPERATOR MODEL NO. SMB-00-10

- VALVE WAS CYCLED 21 TIMES AGAINST FULL FLOW (~245,000 LBM/HR) ON JANUARY 14, 1981

- NO ANOMALIES WERE NOTED; SEAT LEAKAGE WAS 0.0 GPM

MARSHALL BLOCK VALVE TESTS

PRELIMINARY SUMMARY OF TEST RESULTS

6. WESTINGHOUSE MODEL 3GM88

- INITIAL TESTS PERFORMED IN JULY, 1980 INDICATED THAT THE VALVE WOULD NOT CLOSE AGAINST FULL FLOW

- VALVE WAS ACTUATED WITH ROTORK OPERATOR SET AT 110 FT-LB. AND IN-LINE WITH A CONTROL COMPONENTS PORV

- FURTHER TESTS INDICATED THAT APPROXIMATELY 175 FT-LBS. WERE REQUIRED TO CLOSE THE VALVE AGAINST A FULL FLOW OF ~232,000 LBM/HR

- VALVE WAS ACTUATED WITH A LIMITORQUE OPERATOR MODEL NO. SMB-00-15 ON AUGUST 13, 1980

- VALVE WAS CYCLED 21 TIMES (FULLY OPEN/FULLY CLOSED). NO ANOMALIES WERE NOTED. SEAT LEAKAGE WAS 0.0 GPM

PRELIMINARY SUMMARY OF TEST RESULTS

7. WESTINGHOUSE MODEL 3GM99

- VALVE WAS ORIGINALLY EQUIPPED WITH A LIMITORQUE OPERATOR MODEL NO. SMB-000-10

- VALVE WAS CYCLED TWICE ON JANUARY 12, 1981 AND DID NOT CLOSE FULLY AGAINST FULL FLOW

- VALVE WAS RETURNED TO WESTINGHOUSE FOR MODIFICATION (CHANGE TO VALVE YOKE AND OPERATOR)

- MODIFIED VALVE WITH A LIMITORQUE ACTUATOR MODEL NO. SB-00-15 WAS RETURNED TO MARSHALL AND CYCLED 21 TIMES AGAINST FULL FLOW OF ~244,000 LBM/HR

- SEAT LEAKAGE MEASUREMENTS RANGED FROM 0.0 TO 0.06 GPM

JJC/AD 3/19/81

HISTORY OF CLOSING PROBLEM

- 3GM88 FIRST FAILED TO CLOSE UNDER HIGH-PRESSURE DIFFERENTIAL STEAM FLOW CONDITIONS DURING AN EPRI TEST PROGRAM AT THE MARSHALL STATION (JULY, 1980).

- SEVERAL 3GM88's FAILED TO CLOSE AT TWO PLANT SITES DURING TESTING OF SAFETY INJECTION SYSTEM AT HIGH-PRESSURE DIFFERENTIALS.

- STRAIN GAGES SHOWED CLOSING LOADS TO BE APPROXIMATELY 13,500 POUNDS.

- FULL FLOW TESTS PERFORMED AT PACIFIC PUMPS HAVE CONFIRMED CLOSING LOAD REQUIREMENT OF ≈ 13,500 POUNDS AT 2700 PSI DIFFERENTIAL.

REASON FOR FAILURE TO CLOSE

- OPERATOR SIZE BASED ON 9300-POUND CLOSING LOAD (USED INDUSTRY STANDARD EQUATION)

- OPERATOR SIZE MARGINS MINIMIZED TO REDUCE LOADS AND MINIMIZE POSSIBILITY OF VALVE DAMAGE IF AN OPERATOR STALLS

- OPERATOR SIZING AND TORQUE SWITCH SETTING DID NOT ACKNOWLEDGE CLOSING LOAD AND OPERATOR DYNAMIC CHARACTERISTICS

- THIS RESULTED IN OPERATOR BEING SET UP TO TRIP AT 9300 POUNDS + SMALL MARGIN AGAINST NO FLOW WHILE THE REQUIRED THRUST LOADS COULD BE AS HIGH AS 13,500 POUNDS

Manual Operated Gate Valve Cutaway

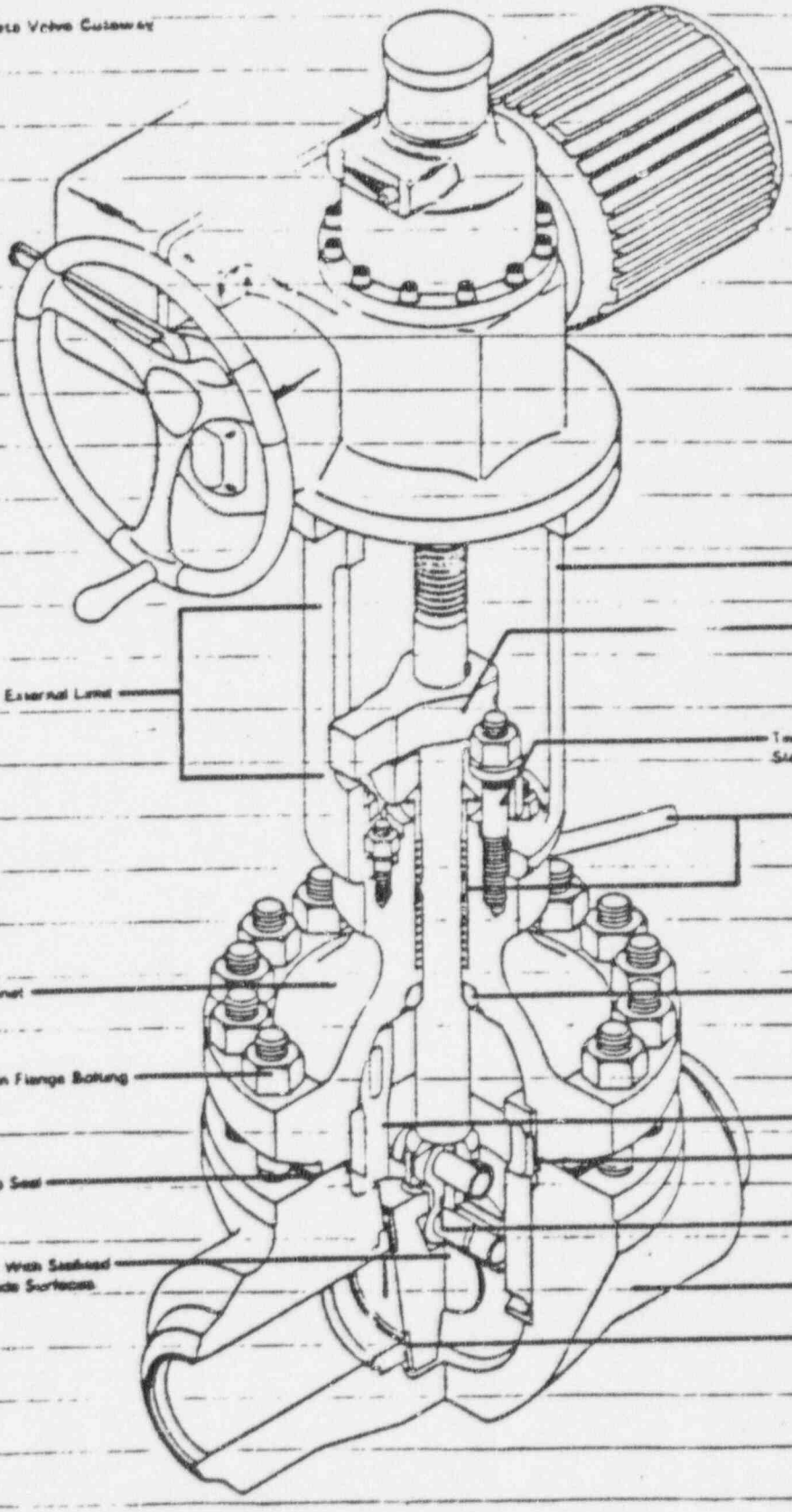
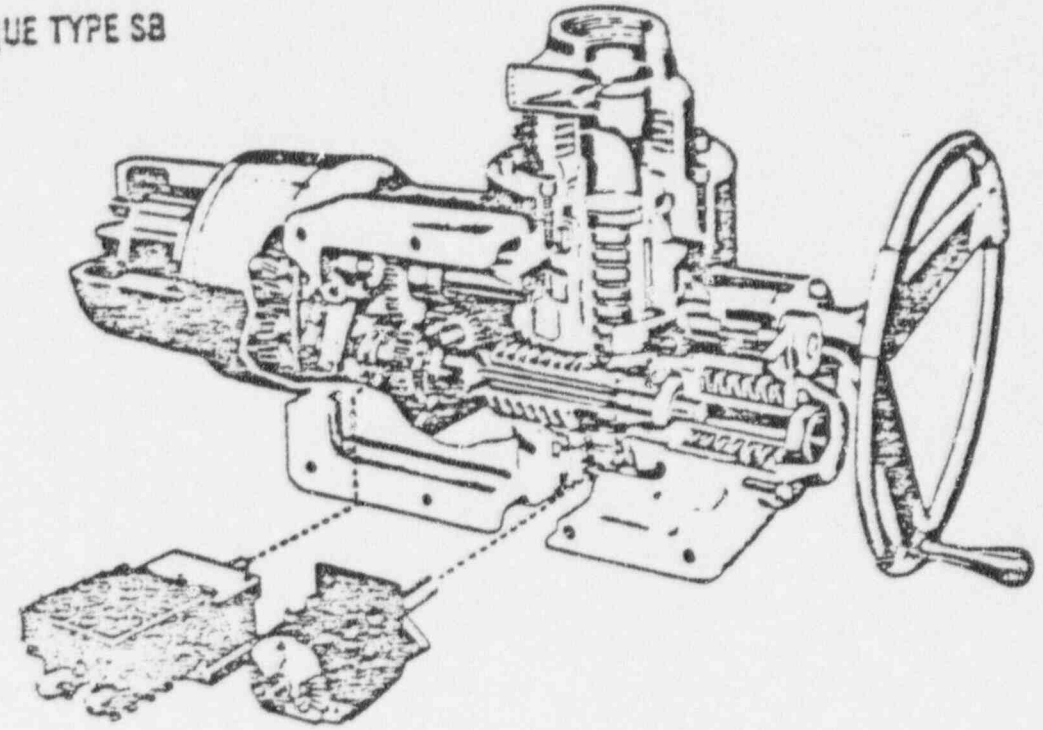
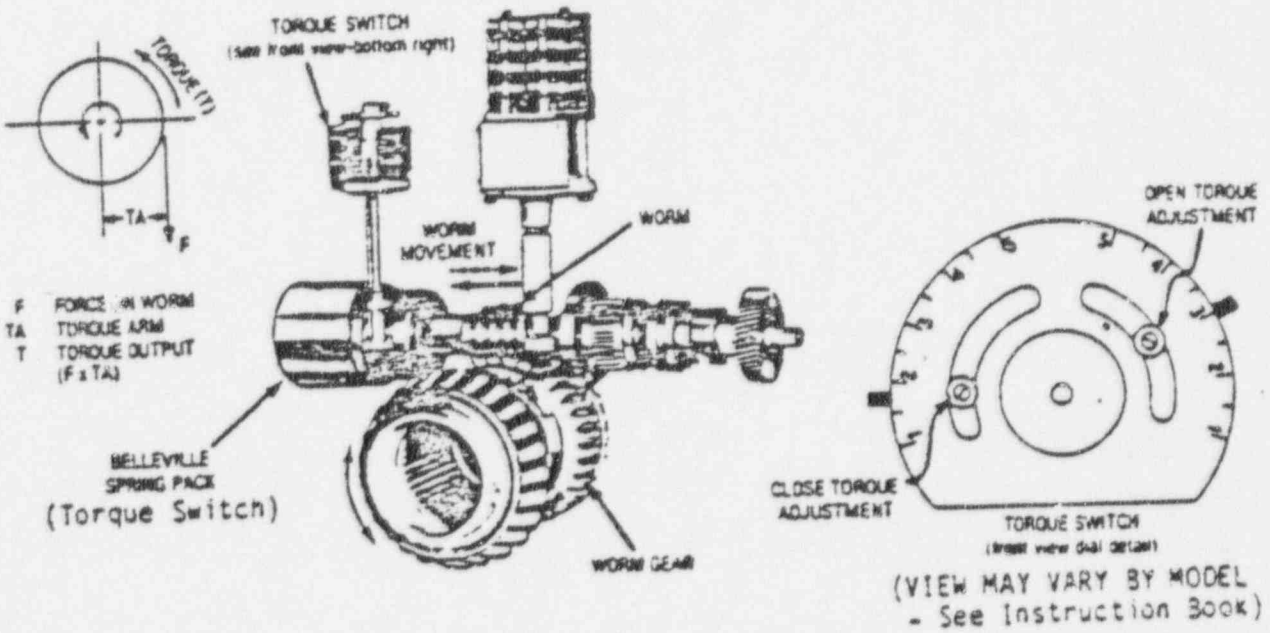


FIGURE 1

LIMITORQUE TYPE SB

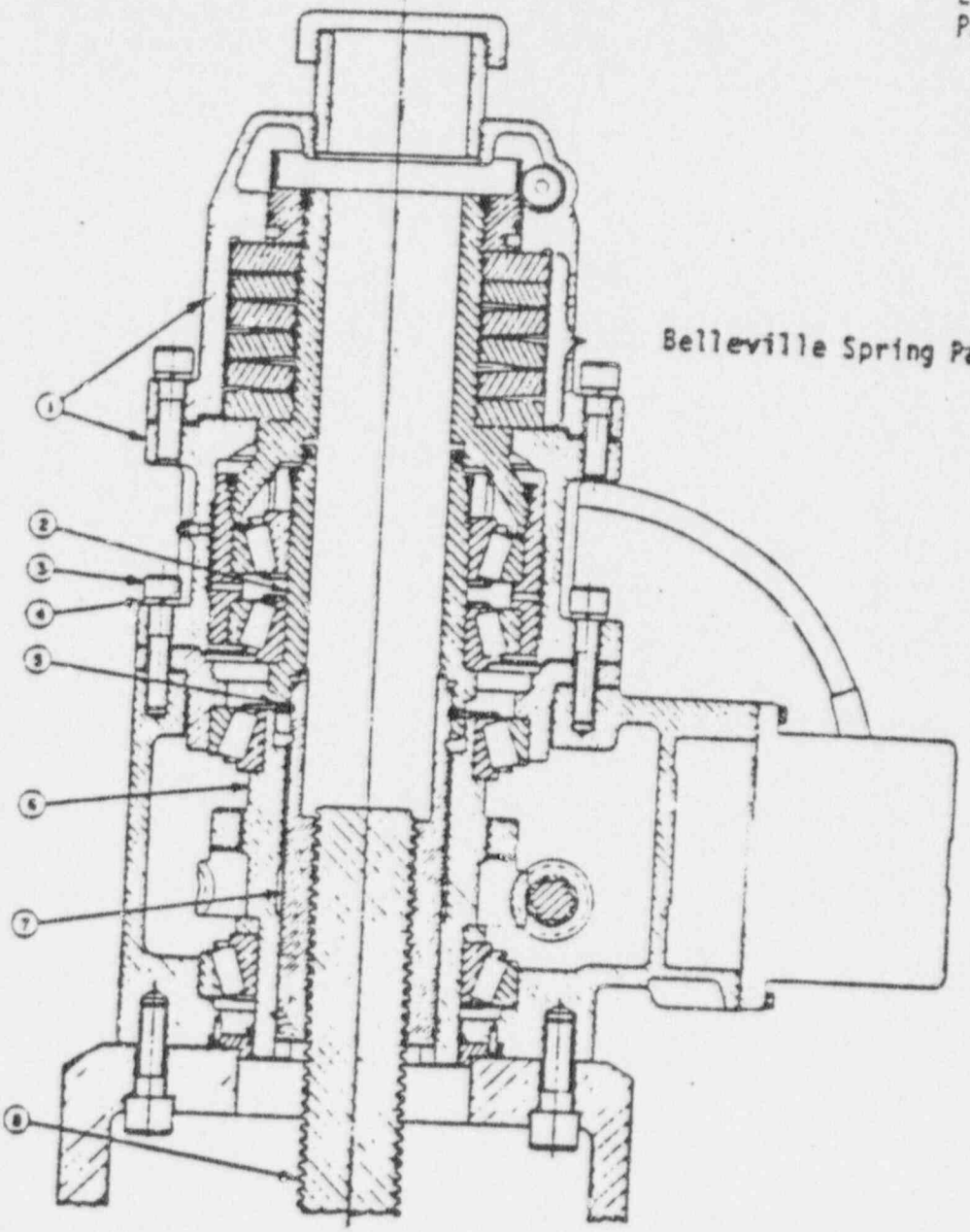




(VIEW MAY VARY BY MODEL - See Instruction Book)

Courtesy of Limitorque Corporation

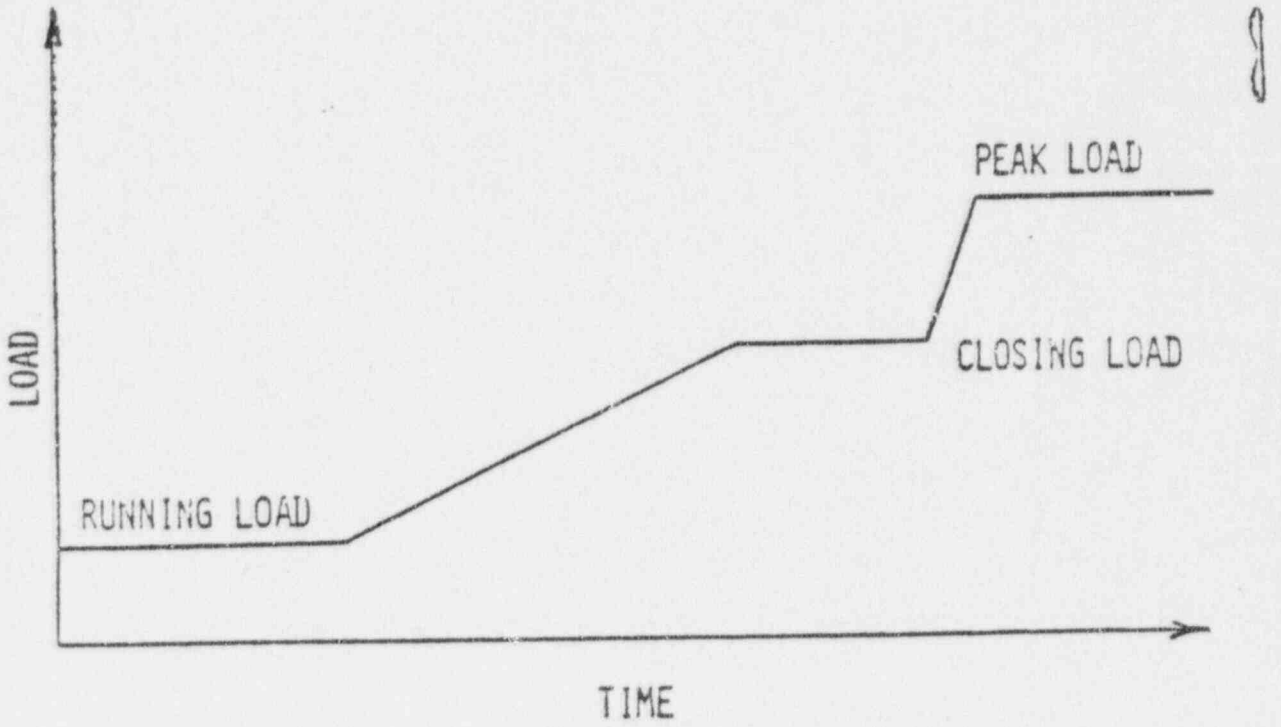
FIGURE 2



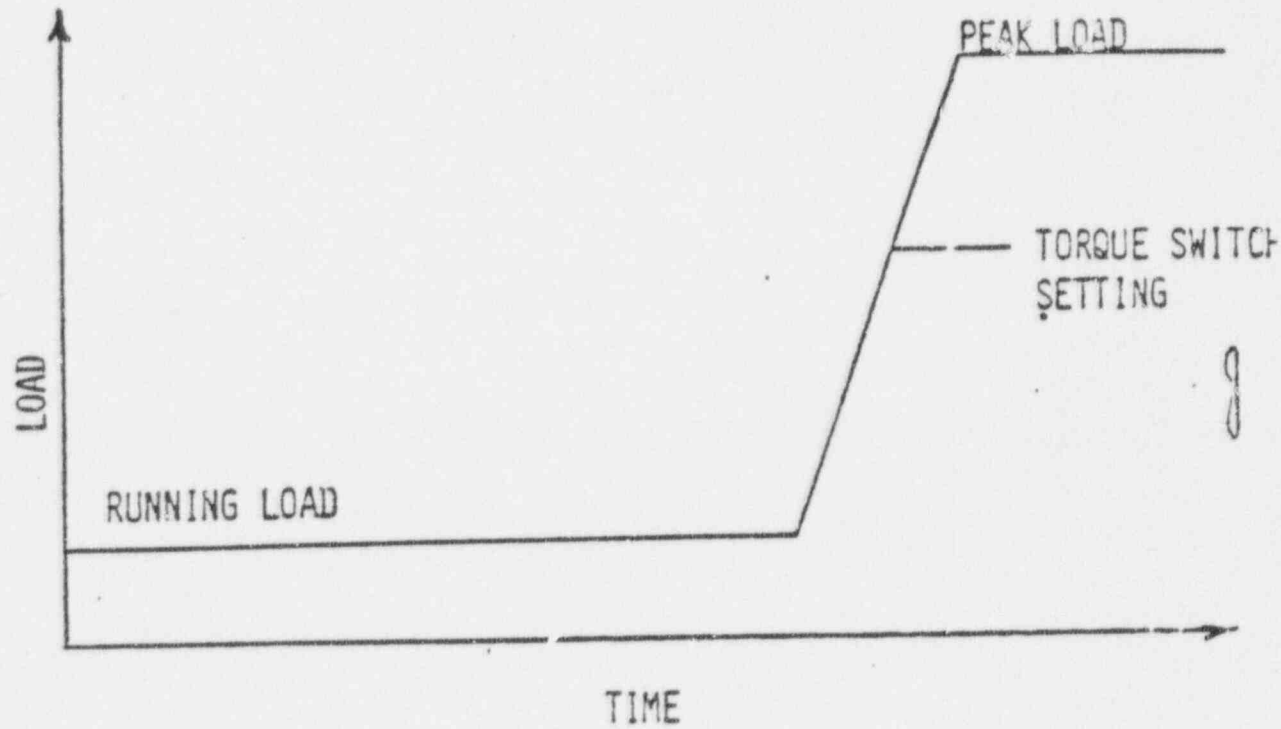
1. Upper Housing Assembly
2. Bearing Cartridge
3. Cap Screw
4. Washer
5. Set Screw
6. Drive Sleeve
7. Nut
8. Stem

Figure 4

VALVE CHARACTERISTICS WITH FLOW



VALVE CHARACTERISTICS WITHOUT FLOW



SUMMARY OF TESTING ACTIVITIES--VALVE CLOSING PROBLEM

1. Water Flow Testing (at Pacific Pump Company)

   Condition up to and including 600 gpm and 2800 psi
   4 valves - 3GM88
   + field modifications } complete
   3 valves - 3GM99
   3 valves - 4GM88

   Field modifications for the 3GM99 and 4GM88 to be tested in early-May.

2. EPRI Steam Flow Tests (PORV Block, Steam Flow)

   1 valve - 3GM88
   1 valve - 3GM99 } complete

3. Site Testing (Full Flow Water Testing, Safety Injection System)

   Almarez: Approximately 10 valves - 3GM88
   CGE: Approximately 10 valves - 3GM88 } complete
   STP: 3 valves - 3GM88

4. EdF (Steam and Water Flow Testing)

   2 valves - 3GM99 — in process

5. Mechanical Fixture Testing (At WEMD)

   Using hydraulic cylinder to duplicate flow loads so force transfer can be studied in depth.

   1 valve - 3GM88
   1 valve - 3GM99 } complete
   1 valve - 4GM88

6. Seat Friction Factor Tests (At Westinghouse R&D)

   To determine stellite on stellite friction factors under water and steam conditions. Test samples are nearing completion at EMD.

J. A. Drake

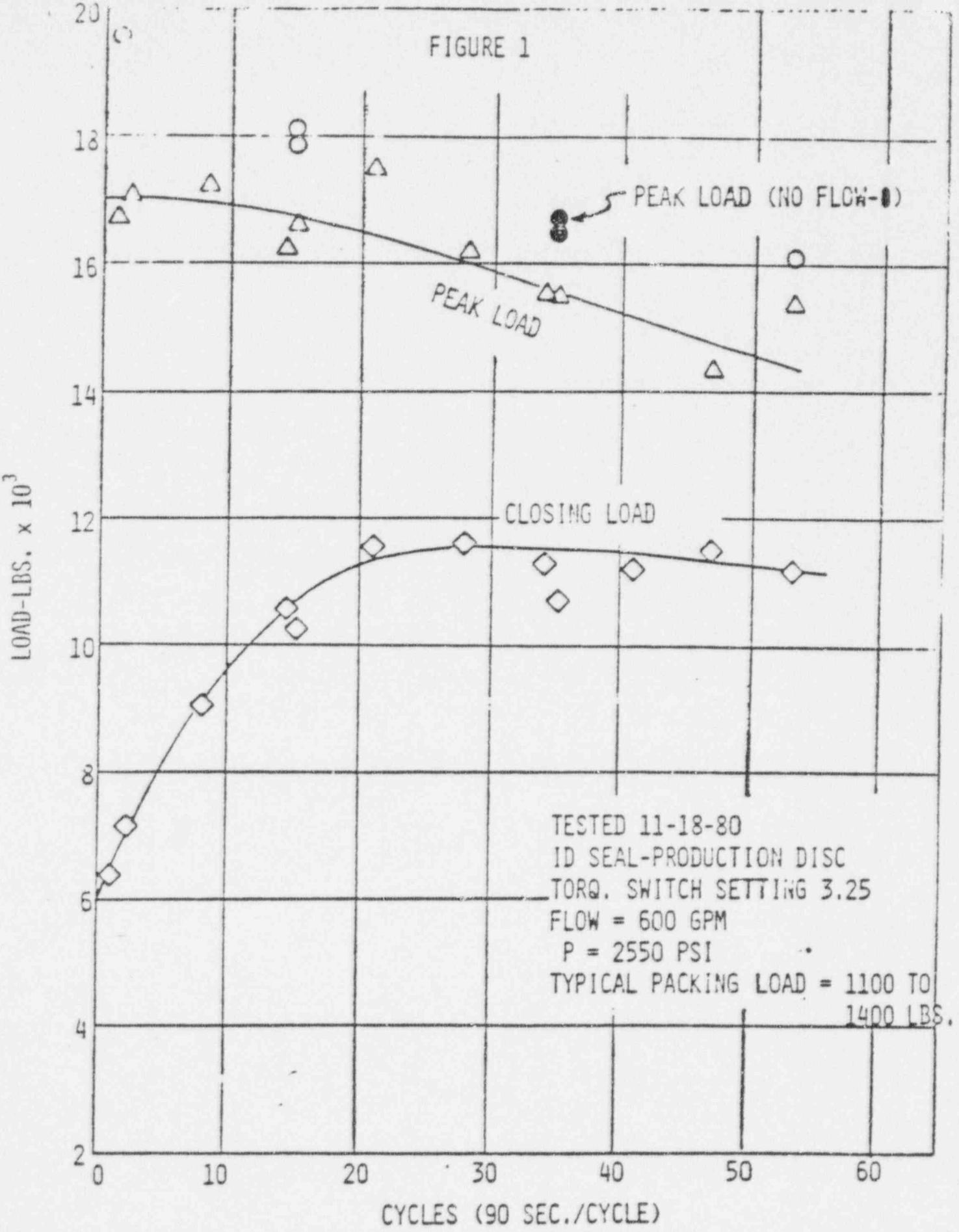
cc: F. R. Bakos
A. F. Phillips

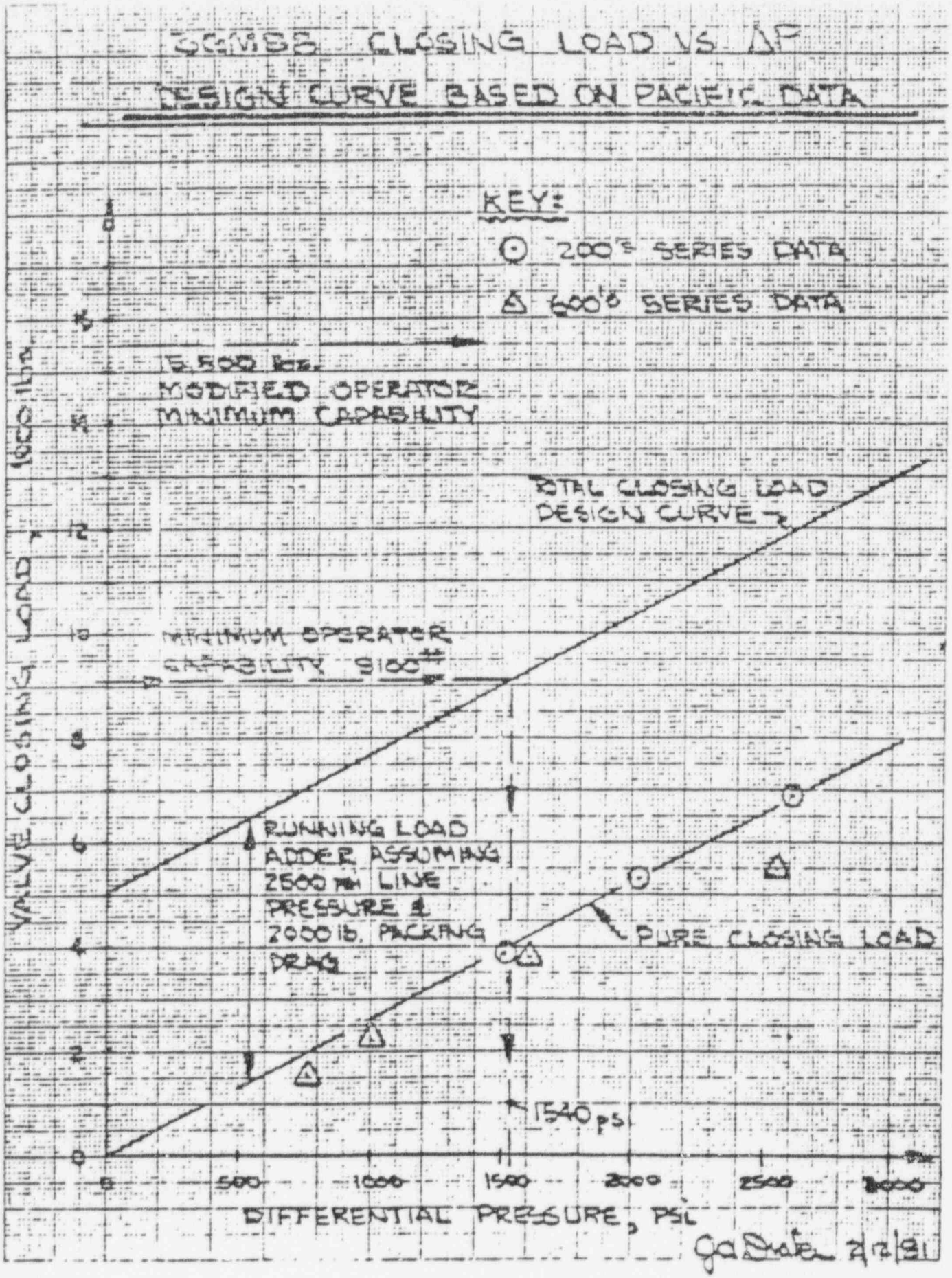
J. A. Drake, Mgr.
Valves and CRDM Eng.

sk

3/19/81

FIGURE 1


PEAK LOAD (NO FLOW-0)
PEAK LOAD
CLOSING LOAD
TESTED 11-18-80
ID SEAL-PRODUCTION DISC
TORQ. SWITCH SETTING 3.25
FLOW = 600 GPM
P = 2550 PSI
TYPICAL PACKING LOAD = 1100 TO 1400 LBS.
LOAD-LBS. x 10^3
CYCLES (90 SEC./CYCLE)
20
18
16
14
12
10
8
6
4
2
0
10
20
30
40
50
60


SGMSB CLOSING LOAD VS ΔP
DESIGN CURVE BASED ON PACIFIC DATA
KEY:
200's SERIES DATA
600's SERIES DATA
15,500 lbs.
MODIFIED OPERATOR
MINIMUM CAPABILITY
TOTAL CLOSING LOAD
DESIGN CURVE
MINIMUM OPERATOR
CAPABILITY 9100#
RUNNING LOAD
ADDER ASSUMING
2500 PSI LINE
PRESSURE &
7000 lb. PACKING
DRAG
PURE CLOSING LOAD
1540 psi
VALVE CLOSING LOAD (1000 lbs.
0
2
4
6
8
10
12
500
1000
1500
2000
2500
3000
DIFFERENTIAL PRESSURE, PSI
Ga Duke 2/2/91

SOLUTION TO VALVE CLOSURE PROBLEM

MODEL 36M88

- REGEAR VALVES TO HAVE 25,000 POUND STALL CAPABILITY
- USE LIMIT SWITCH RATHER THAN TORQUE SWITCH CONTROL

MODEL 36M99 AND 4-INCH VALVES

- MAY REQUIRE CHANGEOUT OF OPERATOR
- USE LIMIT SWITCH CONTROL
- FINAL DECISION TO BE MADE IN APRIL

NORMAL TORQUE
SWITCH CLOSING WITH
SPRING COMPENSATOR

- Loads buildup at seat face as motor torque increases.
- Belleville spring stack permits the stem nut to deflect under stem loads.
- When torque reaches a preset level the torque switch trips the motor.
- Remaining spring stack deflection provides differential thermal expansion protection and absorbs motor inertia.

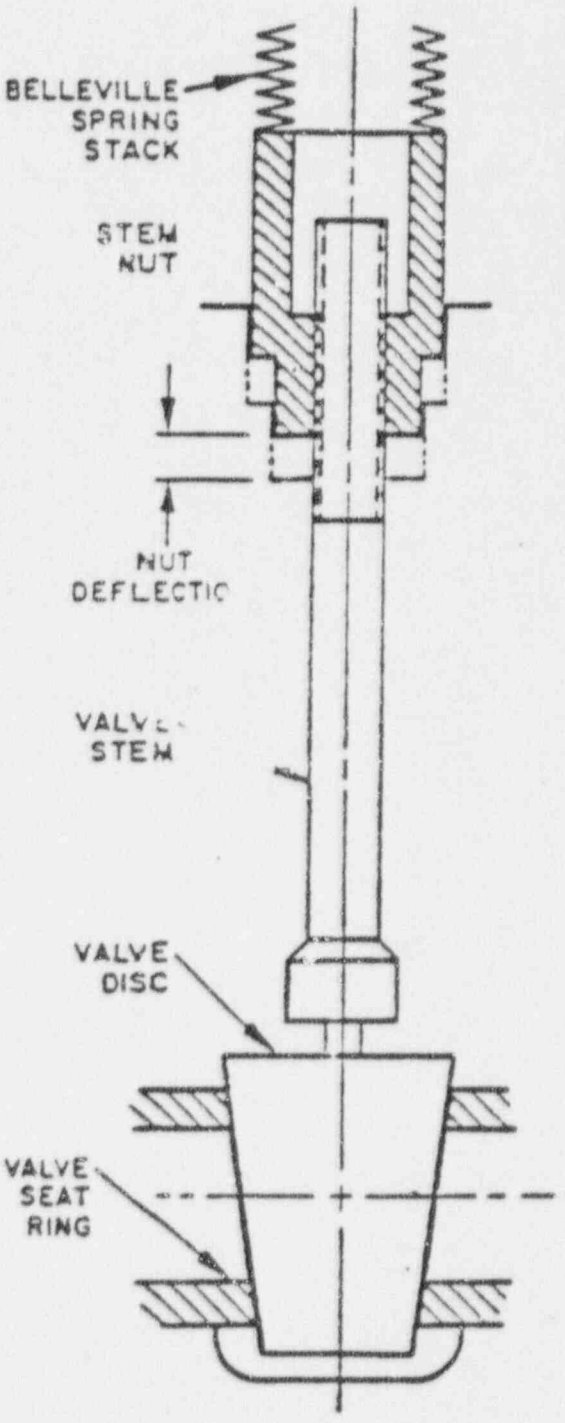


FIGURE 3

TORQUE SWITCH CLOSING AGAINST HIGH FLOW CONDITIONS

- If high flow or ΔP produce high stem loads, torque switch may trip with valve partially open.
- When ΔP reduces, bellevilles will push disc toward closed position.
- If distance open > nut defection, disc will not reach closed position.

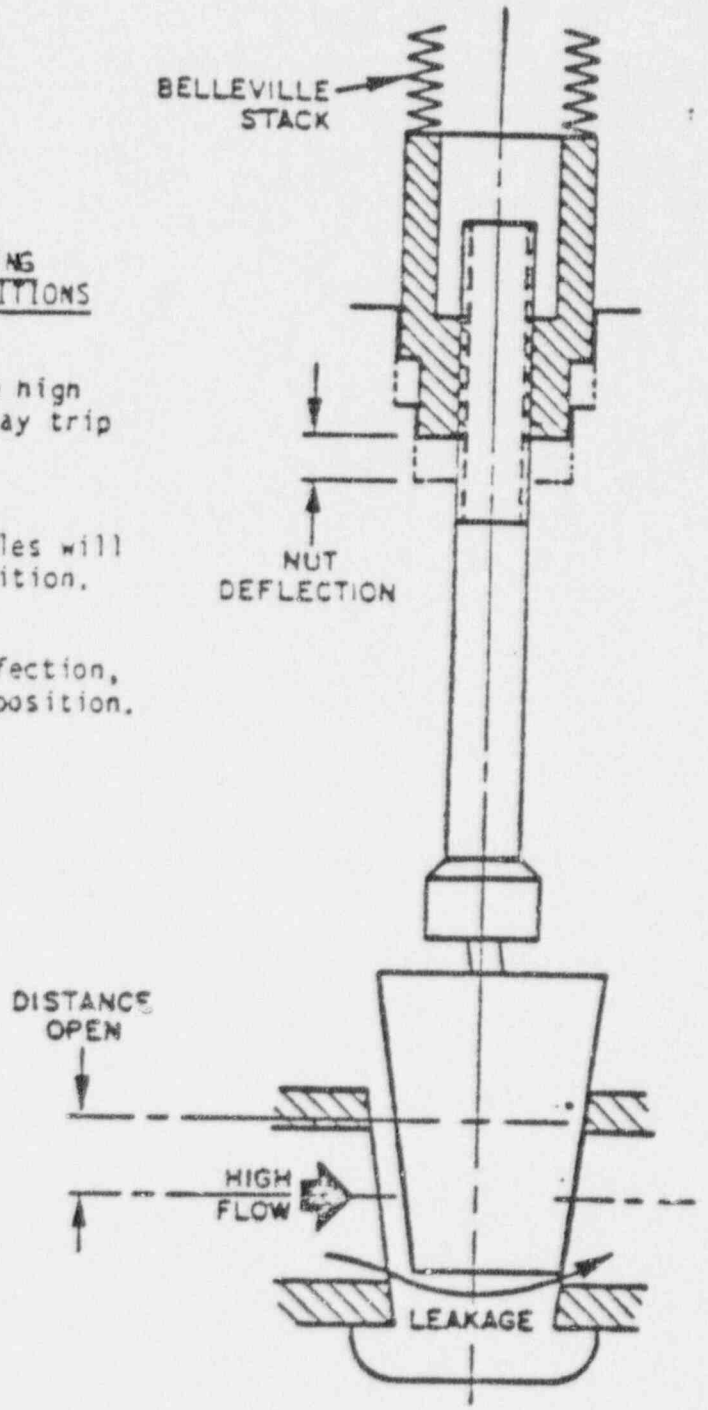


FIGURE 4

LIMIT CLOSING CONTROL ESTABLISHING THE CLOSED LIMIT SWITCH TRIP POSITION

- Operator Handwheel is used deflect the stem nut .280", producing 11,000 lbs of stem thrust.
- Closed limit switch is set at this point.
- On subsequent electrical closings, the limit switch will trip the motor with the 11,000 lb. Preload stem thrust present.

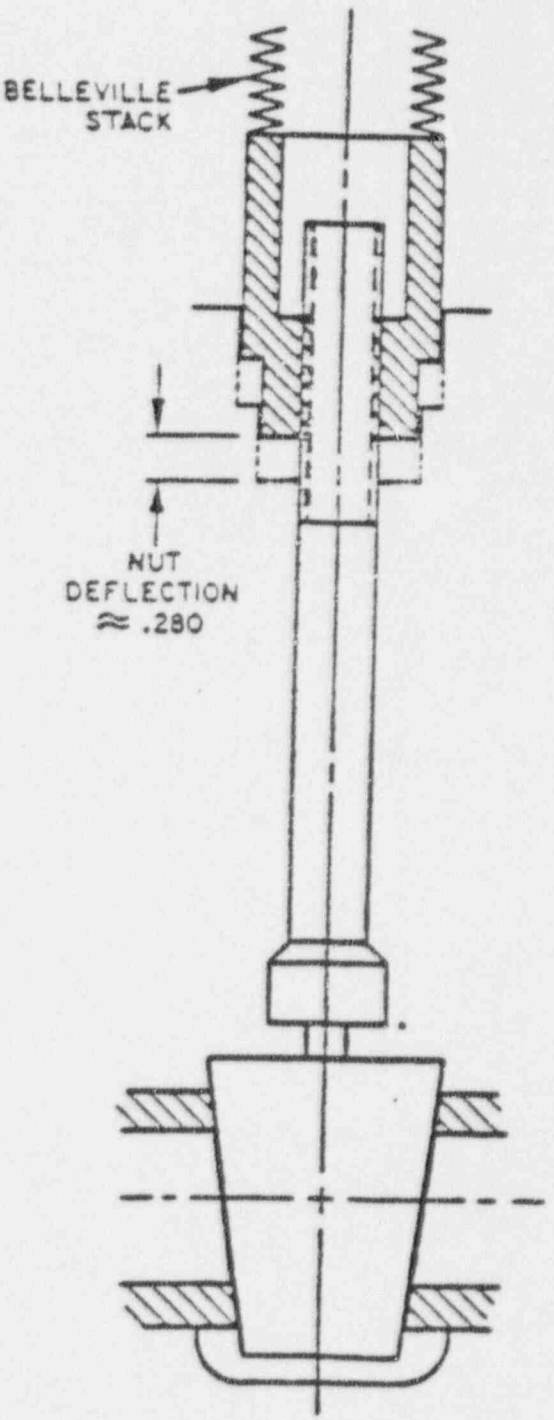


FIGURE 5

LIMIT CONTROL - CLOSING AGAINST FULL FLOW CONDITIONS

- If high flow or ΔP conditions product high stem loads, the operator will produce whatever load is required to reach the limit switch set position.
- $\text{Distance Open} = \frac{\text{Stemload} - 11{,}000 \text{ lbs}}{40{,}000 \text{ lbs/in}}$
- Disc closes off the port allowing only normal spec leak rates.
- Since distance open < the nut deflection, the bellevilles will drive the disc to the seated position if the ΔP drops.

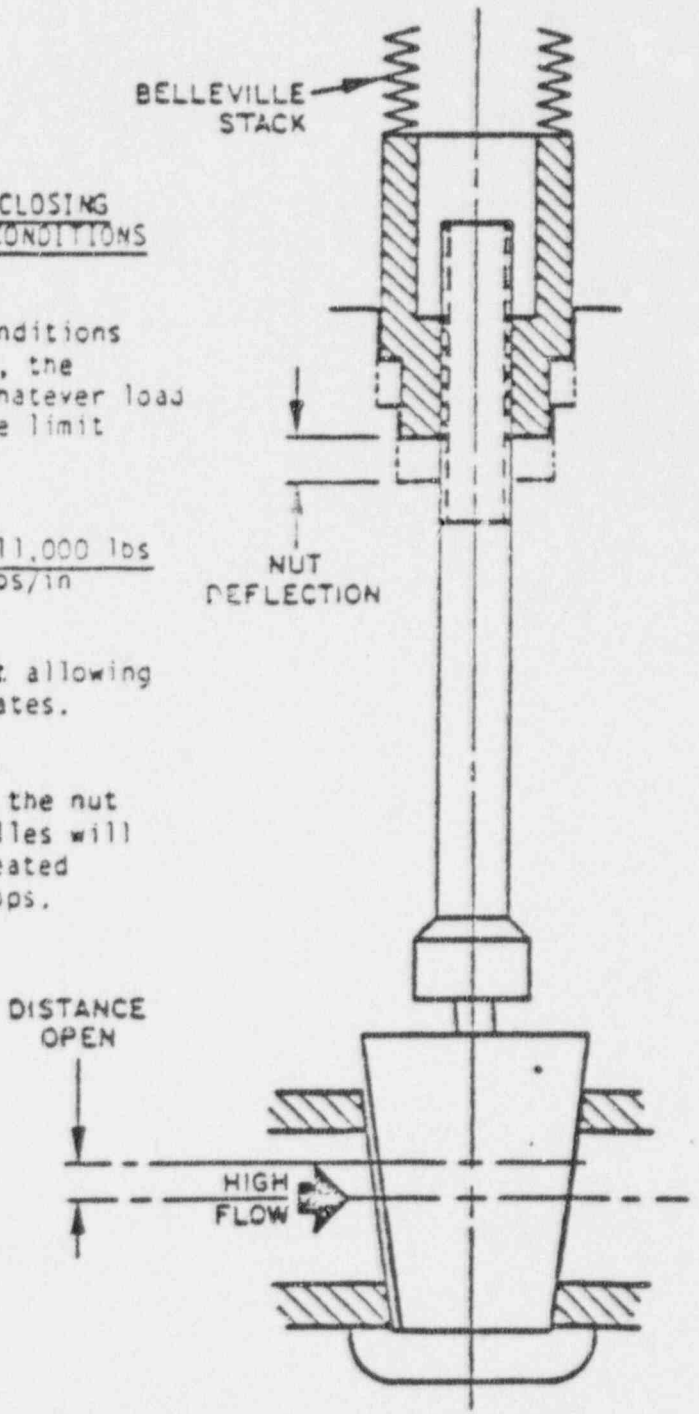


FIGURE 6

CHRONOLOGY

ATTACHMENT 5

JULY 9, 1980	W ADVISED OF MARSHALL TEST RESULTS (3GM88)
JULY - SEPTEMBER	W INVESTIGATIONS INTO BLOCK VALVE SUPPLY FOR NSSS SCOPE AND EVALUATION/RESOLUTION OF VALVE PERFORMANCE AT MARSHALL
SEPTEMBER 16, 1980	SAFETY REVIEW COMMITTEE MEETING ON BLOCK VALVES
	W INVESTIGATIONS EXPANDED TO OTHER 3" GATE VALVE APPLICATIONS AND TO 4" VALVES
SEPTEMBER 25, 1980	W ADVISED NRC BY TELEPHONE OF BLOCK VALVE ISSUE
SEPTEMBER 1980	W ADVISED OF FAILURE OF CERTAIN 3" GATE VALVES TO CLOSE DURING PRE-OP TESTING AT TWO PLANTS
OCTOBER 28, 1980	SAFETY REVIEW COMMITTEE MEETING ON 3" GATE VALVES
	CUSTOMERS NOTIFIED WITHIN 24 HOURS OF POTENTIAL VIOLATION OF 10CFR50.55(E)
OCTOBER 30, 1980	NRC INFORMALLY NOTIFIED OF 3" GATE VALVE ISSUE
NOVEMBER 18-20, 1980	NRC AUDIT AT W
DECEMBER 1980	LABORATORY TESTS ON 3" & 4" GATE VALVES
JANUARY 1981	W NOTIFIED OF MARSHALL TEST RESULTS (3GM99)
JANUARY 15, 1981	W VISITED NRC TO PROVIDE UPDATE OF 3" GATE VALVE ISSUE
FEBRUARY 5, 1981	NRC AUDIT AT W
FEBRUARY 10, 1981	SAFETY REVIEW COMMITTEE ON 3GM99 PLUS 4" GATE VALVES - CUSTOMERS NOTIFIED WITH 24 HOURS OF POTENTIAL VIOLATION OF 10CFR50.55(E)
FEBRUARY 11, 1981	NRC INFORMALLY NOTIFIED OF 3GM99 & 4" VALVE ISSUE

WESTINGHOUSE SAFETY REVIEW OF PORV BLOCK VALVE - FAILURE TO COMPLETELY CLOSE AT RATED TORQUE

SAFETY REVIEW COMMITTEE (SRC) MEETING - SEPTEMBER 16, 1980

- PORV BLOCK VALVES ARE INACTIVE AND ARE NOT SAFETY GRADE
- SAR ANALYSIS FOR THE WORST SMALL HOT LEG BREAK UMBRELLAS THE STUCK OPEN PORV EVENT
- WCAP-9600 SHOWS NO CORE UNCOVERY ASSUMING ALL PORVs STUCK OPEN (NO BLOCK VALVES) WITH MINIMUM SAFEGUARDS

SRC UNANIMOUSLY AGREED THAT IT WAS NOT A SUBSTANTIAL SAFETY HAZARD UNDER 10CFR21 OR A SIGNIFICANT DEFICIENCY UNDER 10CFR50.55(E)

HOWEVER, ALL CUSTOMERS WERE OFFICIALLY NOTIFIED AND NRC WAS INFORMALLY NOTIFIED OF THE ISSUE (SEPTEMBER 25, 1981)

NRC AUDITS ON NOVEMBER 18-20, 1980 AND FEBRUARY 5, 1981 DID NOT DISAGREE WITH THE FINDINGS OF THE WESTINGHOUSE SRC ON THIS SUBJECT.

Options Available to Plants

- Physical modification; or
- Evaluation of specific application against generic functional requirements; or
- In situ testing to confirm adequacy in selected application

ATTACHMENT 6

WY-0-033

NOV 7 1980

Westinghouse Electric Corporation
Water Reactor Divisions

Electro Mechanical Division

Box 217
Sheldwick Pennsylvania 15621
Cable WESTHESWICK
(412) 374 5000
(412) 380 5700
TWX 510-671-650
TELEX 866547

November 1, 1980

Duke Power Company
General Offices
P. O. Box 2178
Charlotte, N.C. 28242

Attention: Mr. S. K. Blackley, Chief Engineer

Subject: Oconee Nuclear Station NSM-502
Your Order No. C-34563
EMD S.O. H066
G.O. CH.13070-EM

Dear Mr. Blackley:

Further to our subject letter, please refer to Attachment A and provide the information requested.

Very truly yours,

A. F. Van Dyke
Sales Contracts

/ns

Attachment

1,2,3RC-004

Attachment A

During preoperational testing at the Virgil C. Summer Station and at a foreign station, problems were encountered when testing the Westinghouse Electro-Mechanical Division manufactured three inch gate valves, Model 3GM88, 1500 lb. class. The later redesign version, 3GM89, may be considered to be subject to the same problem. The tested valves failed to completely close under pre-operational test conditions (i.e., approximately 2700 psi as flow approaches zero), these tests were conducted at a condition less severe than the equip-ment specification design conditions (i.e., 2750 psi as flow approaches zero). The valves stroked to significantly restrict flow, but the full stroke was not accomplished to trip the "closed" position indication contacts in the motor operator or to seat the valve disc within the valve body.

Westinghouse has reviewed the scope of supply for the subject valves. The majority of these valves have been supplied to Westinghouse nonoperating plants as part of the NSSS scope of supply. A smaller number of these valves have been sold directly to several Westinghouse operating plants, as spares or replacements, as well as to non-Westinghouse plants.

Westinghouse has reviewed the application of the subject valves on Westinghouse nonoperating plants. Westinghouse has determined that several of these valves are classified as "active" valves (i.e., mechanical operation is required to accomplish a safety function) and are utilized in the Chemical and Volume Control System and the Emergency Core Cooling System. The functional require-ments for "active" valves include closure under operating pressure/flow conditions. Since the subject valves are utilized in "active" applications on Westinghouse nonoperating plants, the subject failure to completely close was considered reportable only on these nonoperating plants under title 10 CFR 50.55(e).

As part of this review on Westinghouse nonoperating plants, it was determined that the functional requirement pressure/flow condition under which the valves must close may be significantly less than the preoperational test and equip-ment specification conditions under which the valves failed to close. Con-sequently, it is possible that complete closure of the subject valves may be accomplished under actual operating conditions even though complete closure was not accomplished under preoperational test conditions. For example, the operating conditions under which one valve at the Virgil C. Summer Station is required to function is approximately 1200 psi as flow approaches zero, instead of the pressure conditions at which the valve failed to close.

For operating plants, Westinghouse has insufficient information on the intended application, or extent of functional testing performed on these valves, therefore, we cannot make a complete evaluation. In order for you to evaluate if a problem exists, you should determine the following:

1. Have these valves been installed in your plant?

2. Have these valves been installed in a safety related system?

3. Is valve closure required to accomplish a safety related function?

4. Under what functional requirement operating conditions is valve closure required?

5. Has operational testing been performed to verify valve closure under the functional requirement operating conditions?

Attached for your information is a copy of the functional requirement information provided to nonoperating plants. Although this information has not been reviewed for your plant, it may assist in your evaluation.

nction	Valve Location Number	Plant													Maximum ΔP (psi) as Flow Approaches	
		Millstone 2	Byron 1 & 2	Braidwood 1, 2	Vogtle 1, 2	Shearon Harris 1,2,3,4	Beaver Valley 2	Vogtle 1, 2	Cameron 1, 2	Seabrook 1, 2	Wolf Creek	Callaway 1, 2	Comanche Peak 1, 2	Watts Bar 1, 2	Equipment Specification	Funct Requi
ine Iso.	8105	X	X	X				X	X	X	X	X	X	X	2750	270
	8106	X	X	X				X	X	X	X	X	X	X	2750	27
	8107				X	X	X								2750	270
	8108				X	X									2750	270
	8146						X								2750	27
liniflow	8106				X	X	X								2750	270
ve : Iso.	8151									X					2750	60
:tion o.	8801A				X	X	X								2750	1200
	8801B				X	X	X								2750	120
	8803A				X	X	X								2750	120
	8803B				X	X	X								2750	1200
:irculation).	8804				X	X									2750	1200
	8806				X	X									2750	1200
	8814						X								2750	1200
	8816						X								2750	1200
:circulation).	8805				X	X	X									

August 13, 1980 - Limitation motor operator with torque sw. setting of 3.75+ cycled through full test procedure and valve was successful with zero seat leakage.

October 27, 1980 - Westinghouse notifies Duke of 3GM88 failures.

October 28, 1980 - Letter sent to Westinghouse requesting confirmation and resolution of problem.

November 1, 1980 - Westinghouse requests information on valve function.

November 13, 1980 - Steam Production notified by Design Engineering of potential problem.

November 17, 1980 - Meeting held between Design/Licensing and Operation and Maintenance to formulate responsibilities.

November 20, 1980 - (Ken Becreft) Limitorque states 275 ft. lbs. available at 3½ position. Westinghouse states that motor will stall at 80% voltage at much lower foot-pound rating - maximum torque sw. to 2.8.

11/81

November 26, 1980 - Unit 2's valve torque switch setting is increased from 1.8 to 2.8.

11/81

12/81

February 9, 1980 - Final Westinghouse specification for field modification of valves received by Oconee.

February 19, 1980 - Unit 3 valve modified.

3/18/81 Unit 2 valve modified

RECEIVED BY
SKB - M/N DP
OCT 3 0 1980
FRJ

WV-0-007

OCT 31 1980

Westinghouse Electric Corporation
Water Reactor Divisions

Electro Mechanical Division

Box 217
Cheswick Pennsylvania 15024
Cable WESTESWICK
(412) 274 8000
(412) 000 0700
TWX 5104071600
TELEX 866547

October 27, 1980

Duke Power Company
General Offices
P.O. Box 2178
Charlotte, N.C. 28242

Attention: Mr. S. K. Blackley, Chief Engineer

Subject: Oconee Nuclear Station
Your Order No. C-34663
END S.O. H066
G.O. CH.18070-DN

NSM-502

Dear Mr. Blackley:

Our records indicate that Westinghouse has supplied to you P.O. Item No. 1
2, 3" Gate Valves, Model 03DCUGM66FNH00 for the above order.

The purpose of this letter is to notify you that 3" gate valves of this
type have been tested under conditions of high flow and pressure differences.
The small number of valves tested thus far did not completely close. Further
tests will be conducted to evaluate the cause and recommended corrective action.

It is recommended that you evaluate the implications of this potential condition
for your specific application.

Westinghouse will continue to keep you informed as this issue is further defined.

Sincerely,

W. F. Van Dyke
Valve Contracts

/mc

cc: Mr. C. Robinson, Quality Control Manager

ATTACHMENT 7

~~Mr. E. R. Smith, Jr.~~ NOTED [stamp] 1980 J.T.R.

> TO: ~~D. W. Liggett~~

~~D W Spangler~~

FYI

DWL has been following valve failure to close item

ER

Westinghouse Electric Corporation

Box 4808
Atlanta Georgia 30302

October 27, 1980

VPA-80-123

Mr. B. R. Sylvia, Manager
Nuclear Operations and Maintenance
Virginia Electric and Power Company
P. O. Box 26666
Richmond, Virginia 23261

Dear Mr. Sylvia:

Virginia Electric and Power Company
Surry Units 1 and 2, North Anna Unit 1
PORV BLOCK VALVE - FAILURE TO CLOSE AT RATED TORQUE

In response to NUREG-0578, Item 2.1.2, EPRI is conducting a safety and relief valve test program. As part of the program, EPRI has initiated pressurizer relief valve (PORV) testing at the Marshall Steam Station (Duke Power); the physical test arrangement at the Marshall Steam Station includes a PORV block valve. However, it should be noted that block valve testing is not included in the EPRI Safety and Relief Valve Test Program as currently defined. The NRC has recently issued further clarification of NUREG-0578 and an additional requirement (to be finalized during October) indicating that "...evidence supported by test that the block or isolation valves between the pressurizer and each power operated relief valve can be operated, closed and opened for all fluid conditions expected under operating and accident conditions" should be provided (by each PWR Licensee) by July 1, 1982.

The following information is being provided to advise you of results of tests conducted on the Westinghouse designed gate valve used for the PORV block valve application. It should be noted that plant specific Safety Analysis Report documentation states that the function of the block valve is to seal off leakage through and to provide for maintenance of the PORV and identifies the PORV block valve as inactive.

During initial checkout of the test loop at the Marshall Steam Station, the Westinghouse block valve did not close completely against 240,000 lb/hr steam flow from a 2400 psi source at 600°F. As installed, the valve was able to block 87 percent of the flow area. After the motor operator was modified to provide higher output thrust, the valve was able to close completely during repeated cycling against this steam flow. Subsequent inspection showed the valve internals to be in excellent condition.

The consequences of incomplete closure of the block valve have been reviewed and it has been determined that this situation does not constitute a reportable safety issue. The failure of a PORV to close (and assuming no block valve) is an analyzed condition and as detailed in WCAP-9600, core uncovery will not occur even if all relief lines remain completely open (i.e., depending on plant specific design, two or three stuck open PORVs and assuming no block valves), assuming minimum safeguards.

Westinghouse is currently preparing a valve operator gear modification which will provide the higher output thrust required to close the Westinghouse block valve against flow.

Very truly yours,

George K. Griffiths

G. K. Griffiths, Manager
Southern Area

0012A

cc: J. T. Rhodes
J. L. Wilson
J. L. Perkins
W. R. Cartwright
E. A. Baum
L. M. Girvin
F. M. Alligood
V. W. Lockman W

WV-0-010

Westinghouse Electric Corporation
Water Reactor Divisions

Electro Mechanical Division

Box 217
Cheswick Pennsylvania 15024
Cable WECHESWICK
(412) 274 6300
(412) 363 9700
TWX 5104671660
TELEX 866547

October 27, 1980

Virginia Electric and Power Company
General Offices
P.O. Box 26666
Richmond, Virginia 23261

Attention: Mr. W. R. France

Subject: Motor Operated Gate Valve
for Surry Power Station
Your Order No. 52096
Our G.O. RM-64197-EM
EMD S.O. H-117

Dear Mr. France:

Our records indicate that Westinghouse has supplied to you two (2) 3GM88FNB Gate Valves for the subject order.

The purpose of this letter is to notify you that 3" gate valves of this type have been tested under conditions of high flow and pressure differences. The small number of valves tested thus far did not completely close. Further tests will be conducted to evaluate the cause and recommended corrective action.

It is recommended that you evaluate the implications of this potential condition for your specific application.

Westinghouse will continue to keep you informed as this issue is further defined.

Sincerely,

W. F. Van Dyke
Valve Contracts

/md

WV-0-010

Westinghouse Electric Corporation
Water Reactor Divisions

Electro Mechanical Division

Box 217
Chadwick Pennsylvania 15024
Cable WECHESWICK
(412) 274 6300
(412) 363 8700
TWX 5104871660
TELEX 866547

October 27, 1980

Virginia Electric and Power Company
General Offices
P.O. Box 26666
Richmond, Virginia 23261

Attention: Mr. W. R. France

Subject: Motor Operated Gate Valve
for Surry Power Station
Your Order No. 52096
Our G.O. RM-64197-EM
EMD S.O. H-117

Dear Mr. France:

Our records indicate that Westinghouse has supplied to you two (2) 3GM88FNB Gate Valves for the subject order.

The purpose of this letter is to notify you that 3" gate valves of this type have been tested under conditions of high flow and pressure differences. The small number of valves tested thus far did not completely close. Further tests will be conducted to evaluate the cause and recommended corrective action.

It is recommended that you evaluate the implications of this potential condition for your specific application.

Westinghouse will continue to keep you informed as this issue is further defined.

Sincerely,

W. F. Van Dyke
Valve Contracts

/md

E. R. ~~Smith, Jr.~~

Rec'd DWL
pm 11/6/80

DWL
Your action
ERS

Westinghouse Electric Corporation

Box 4208
Atlanta Georgia 30302

NOTED NOV 5 1980 J.T.R.

October 31, 1980
VPA-80-126

Mr. B. R. Sylvia, Manager
Nuclear Operations and Maintenance
Virginia Electric and Power Company
P. O. Box 26666
Richmond, Virginia 23261

Dear Mr. Sylvia:

Virginia Electric and Power Company
Surry Units 1 and 2, North Anna Unit 1
WESTINGHOUSE 3" GATE VALVE CLOSURE PROBLEM

The Westinghouse Safety Review Committee met on October 28, 1980 to review a problem of valve closure failure at Westinghouse nonoperating plants during preoperational testing. The committee determined this was a significant deficiency and you were verbally notified on October 28, 1980. This letter formalizes that notification persuant to title 10CFR50.55(E).

Attached are the details of this problem and if we can provide additional clarifications, please contact the undersigned.

Very truly yours,

G. K. Griffiths, Manager
Southern Area

0010A

cc: ~~J. T. Rhodes~~
J. L. Wilson
J. L. Perkins
~~W. G. Cartwright~~
~~E. A. Baum~~
L. M. ~~Sirvio~~
F. M. Alligood
~~E. M. Lockman~~ W

During preoperational testing at a domestic station and at a foreign station, problems were encountered when testing the Westinghouse Electro-Mechanical Division manufactured three inch gate valves, Model 3GM88, 1500 lb. class. The later redesign version, 3GM99, may be considered to be subject to the same problem. The tested valves failed to completely close under preoperational test conditions (i.e., approximately 2700 psi as flow approaches zero), these tests were conducted at a condition less severe than the equipment specification design conditions (i.e., 2750 psi as flow approaches zero). The valves stroked to significantly restrict flow, but the full stroke was not accomplished to trip the "closed" position indication contacts in the motor operator or to seat the valve disc within the valve body.

Westinghouse has reviewed the scope of supply for the subject valves. The majority of these valves have been supplied to Westinghouse nonoperating plants as part of the NSSS scope of supply. A smaller number of these valves have been sold directly to several Westinghouse operating plants, as spares or replacements, as well as to non-Westinghouse plants.

Westinghouse has reviewed the application of the subject valves on Westinghouse nonoperating plants. Westinghouse has determined that several of these valves are classified as "active" valves (i.e., mechanical operation is required to accomplish a safety function) and are utilized in the Chemical and Volume Control System and the Emergency Core Cooling System. The functional requirements for "active" valves include closure under operating pressure/flow conditions. Since the subject valves are utilized in "active" applications on Westinghouse nonoperating plants, the subject failure to completely close was considered reportable only on these nonoperating plants under title 10 CFR 50.55(e).

As part of this review on Westinghouse nonoperating plants, it was determined that the functional requirement pressure/flow condition under which the valves must close may be significantly less than the preoperational test and equipment specification conditions under which the valves failed to close. Consequently, it is possible that complete closure of the subject valves may be accomplished under actual operating conditions even though complete closure was not accomplished under preoperational test conditions. For example, the operating conditions under which the valve at the domestic station is required to function is approximately 1200 psi as flow approaches zero, instead of the pressure conditions at which the valve failed to close.

For operating plants, Westinghouse has insufficient information on the intended application, or extent of functional testing performed on these valves, therefore, we cannot make a complete evaluation. In order for you to evaluate if a problem exists, you should determine the following:

1. Have these valves been installed in your plant?

2. Have these valves been installed in a safety related system?

3. Is valve closure required to accomplish a safety related function?

4. Under what functional requirement operating conditions is valve closure required?

5. Has operational testing been performed to verify valve closure under the functional requirement operating conditions?

Listed below for your information is a summary of typical functional requirement information for various valve applications in nonoperating plants. Although this information is not available for your plant, it may assist in your evaluation. Westinghouse is continuing its efforts to develop additional information concerning this problem and to develop appropriate modifications. You will be notified accordingly as this additional information becomes available.

System	Valve Function	Maximum ΔP (psi) as Flow Approaches Zero	
		Equipment Specification	Functional Requirement
CVCS	Charging Line Isolation	2750	2700
CVCS	Chg. Pump Miniflow Isolation	2750	2700
CVCS	Letdown Line Containment Isolation	2750	600
ECCS	Boron Injection Tank Isolation	2750	1200
ECCS	Hot Leg Recirculation Iso.	2750	1200
ECCS	Cold Leg Recirculation Iso.	2750	1200

WV-0-032

Westinghouse Electric Corporation Power Systems

Electro Mechanical Division

Box 217
Cheswick Pennsylvania 15024
Cable WESCHESWICK
(412) 274 6300
(412) 363 8700

November 1, 1980

Virginia Electric and Power Company
General Offices
P. O. Box 2666
Richmond, Virginia 23261

Attention: Mr. W. R. France

Subject: Motor Operated Gate Valve
for Surry Power Station
Your Order No. 52096
Our G.O. RM-64197-EM
EMD S.O. H-117

Dear Mr. France:

Further to our subject letter, please refer to Attachment A and provide the information requested.

Very truly yours,

W. F. Van Dyke
Valve Contracts

/md

Attachment

Attachment A

During preoperational testing at the Virgil C. Summer Station and at a foreign station, problems were encountered when testing the Wesitnghouse Electro-Mechanical Division manufactured three inch gate valves, Model 3GM88, 1500 lb. class. The later redesign version, 3GM99, may be considered to be subject to the same problem. The tested valves failed to completely close under pre-operational test conditions (i.e., approximately 2700 psi as flow approaches zero), these tests were conducted at a condition less severe than the equipment specification design conditions (i.e., 2750 psi as flow approaches zero). The valves stroked to significantly restrict flow, but the full stroke was not accomplished to trip the "closed" position indication contacts in the motor operator or to seat the valve disc within the valve body.

Westinghouse has reviewed the scope of supply for the subject valves. The majority of these valves have been supplied to Westinghouse nonoperating plants as part of the NSSS scope of supply. A smaller number of these valves have been sold directly to several Westinghouse operating plants, as spares or replacements, as well as to non-Westinghouse plants.

Westinghouse has reviewed the application of the subject valves on Westinghouse nonoperating plants. Westinghouse has determined that several of these valves are classified as "active" valves (i.e., mechanical operation is required to accomplish a safety function) and are utilized in the Chemical and Volume Control System and the Emergency Core Cooling System. The functional requirements for "active" valves include closure under operating pressure/flow conditions. Since the subject valves are utilized in "active" applications on Westinghouse nonoperating plants, the subject failure to completely close was considered reportable only on these nonoperating plants under title 10 CFR 50.55(e).

As part of this review on Westinghouse nonoperating plants, it was determined that the functional requirement pressure/flow condition under which the valves must close may be significantly less than the preoperational test and equipment specification conditions under which the valves failed to close. Consequently, it is possible that complete closure of the subject valves may be accomplished under actual operating conditions even though complete closure was not accomplished under preoperational test conditions. For example, the operating conditions under which one valve at the Virgil C. Summer Station is required to function is approximately 1200 psi as flow approaches zero, instead of the pressure conditions at which the valve failed to close.

For operating plants, Westinghouse has insufficient information on the intended application, or extent of functional testing performed on these valves, therefore, we cannot make a complete evaluation. In order for you to evaluate if a problem exists, you should determine the following:

1. Have these valves been installed in your plant?

2. Have these valves been installed in a safety related system?

3. Is valve closure required to accomplish a safety related function?

4. Under what functional requirement operating conditions is valve closure required?

5. Has operational testing been performed to verify valve closure under the functional requirement operating conditions?

Attached for your information is a copy of the functional requirement information provided to nonoperating plants. Although this information has not been reviewed for your plant, it may assist in your evaluation.

Valve Function	Valve Location Number	Plant													Maximum ΔP (psi) as Flow Approaches Z	
		Millstone 3	Byron 1 & 2	Braidwood 1, 2	Virgil C. Summer	Shearon Harris 1,2,3,4	Beaver Valley 2	Vogtle 1, 2	Jamesport 1, 2	Seabrook 1, 2	Marble Hill 1, 2	Wolf Creek	Callaway 1, 2	Comanche Peak 1, 2	Watts Bar 1, 2	Equipment Specification	Functio Require
Charging Line Iso.	8105	X	X	X				X	X	X	X	X	X	X	X	2750	270
"	8106	X	X	X				X	X	X	X	X	X	X	X	2750	270
"	8107				X	X	X									2750	270
"	8108				X	X										2750	270
"	8146						X									2750	270
Chg. Pump Miniflow Iso.	8106				X	X	X									2750	270
Letdown Line Containment Iso.	8151									X						2750	60
Boron Injection Tank Iso.	8801A				X	X	X									2750	1200
"	8801B				X	X	X									2750	1200
"	8803A				X	X	X									2750	1200
"	8803B				X	X	X									2750	1200
Hot Leg Recirculation Iso.	8884				X	X										2750	1200
"	8886				X	X										2750	1200
"	8814						X									2750	1200
"	8816						X									2750	1200
Cold Leg Recirculation Iso.	8885				X	X	X									2750	1200

WV-0-067

Westinghouse Electric Corporation
Power Systems Company

Electro-Mechanical Division
Box 217
Cheswick, Pennsylvania 15024
Cable WECHESWICK
(412) 274-6300
(412) 363-8700

November 14, 1980

Virginia Electric and Power Company
General Offices
P. O. Box 2666
Richmond, Virginia 23261

Attention: Mr. W. R. France

Subject: Motor Operated Gage Valve
for Surry Power Station
Your Order No. 52096
Our G.O. RM-64197-EM
EMD S.O. H-117

Dear Mr. France:

By our letter of October 27, 1980, you were informed that 3-inch motor operated valves were tested under conditions of high flow and pressure differences and that a small number of those tested did not close. In this letter, it was recommended that you evaluate the implications of this potential condition for your specific application, identified in the subject, above.

Attachment A to our letter of November 1, 1980, further identified this condition and in greater detail. Five specific questions were posed to which your answers are required by Westinghouse to make an evaluation.

You are requested to provide this information to WEMD by November 19, 1980, or identify by that date when you will provide the information needed. Your assistance in this matter is required so that we can continue to be of service to you.

Very truly yours,

W. F. VanDyke
Valve Contracts

WFV/gac

Westinghouse
Electric Corporation

Box 4008
[illegible]
Atlanta, Georgia 30302

February 12, 1981

VPA-81-511

Mr. B. R. Sylvia, Manager
Nuclear Operations & Maintenance
Virginia Electric and Power Company
P. O. Box 26666
Richmond, Virginia 23261

Dear Mr. Sylvia:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY UNITS 1 & 2 - NORTH ANNA UNITS 1 & 2
WESTINGHOUSE EHD VALVE ISSUES

In October 1980, Westinghouse informed you that plant preoperational tests disclosed that Westinghouse Electro Mechanical Division manufactured three inch gate valves, model 3GM88, 1500 lb. cla[illegible] failed to completely close under preoperational test conditions (i.e., approximately 2700 PSID as flow approaches zero). These conditions were less severe than the equipment specification design conditions (i.e., 2750 PSID as flow approaches zero). At that time Westinghouse also reported that the later redesigned version of this valve, the model 3GM99, may also be subject to the same problem although no testing was performed on this model.

Westinghouse instituted an engineering investigation to determine the cause of the problem, laboratory testing has verified that the model 3GM99 will not close when subjected to the same preoperational test hydraulic conditions. These tests also showed that the problem is extended to the Westinghouse 4 inch model 4GM87 and 4GM88 valves.

The scope of supply for these valves is similar to that of the model 3GM88. The majority have been supplied to Westinghouse nonoperating plants as part of the NSSS scope of supply while a smaller number have been sold direct by the Electro Mechanical Division to operating plants (both Westinghouse and non-Westinghouse) as spares or replacements.

Westinghouse has determined that for nonoperating plants, several of these valves are classified as "active" (i.e., mechanical motion is required to perform a safety function). The functional requirements for "active" valves include closure under operating pressure/flow conditions. Since the [illegible]

valves are utilized in "active" applications on Westinghouse non operating plants, failure to completely close was considered reportable only on those non operating plants under title 10CFR 50.55 (e). Westinghouse will make no formal USNRC notification of this problem.

It was determined that the functional requirement (pressure/flow) condition under which the valves must close may be significantly less than the pre-operational test and equipment specification conditions under which the valves failed to close. Consequently, it is possible that complete closure of the subject valves may be accomplished under actual operating conditions even though complete closure was not accomplished under test conditions.

For operating plants, Westinghouse has insufficient information on the intended application, or extent of functional testing performed on these valves since they were provided on a spare or replacement basis. In order for you to complete your own safety evaluation you should determine the following:

1) Have these valves been installed in your plant?

2) Have these valves been installed in a safety related system?

3) Is valve closure required to accomplish a safety related function?

4) Under what functional requirement operating conditions is valve closure required?

5) Has operational testing been performed to verify valve closure under the functional requirement operating conditions?

Listed below for your information is a summary of typical functional requirements for various valve applications in Westinghouse non operating plants. This information is provided to assist you in determining your actual functional conditions.

		Maximum ΔP (psi) as Flow Approaches Zero	
System	Valve Function	Equipment Specification	Functional Requirement*
CVCS	Charging Line Isolation	2750	2700
CVCS	Charging Pump Miniflow Isolation	2750	2700
CVCS	Letdown Line Containment Isolation	2750	600
ECCS	Boron Injection Tank Isolation	2750	1200
ECCS	Hot Leg Recirculation Isolation	2750	1200
ECCS	Cold Leg Recirculation Isolation	2750	1200
CVCS	Letdown Line Isolation	2750	2700

The repair for the 3 inch valves under consideration is as follows:

3GM88
1. Change the operator gear ratio to insure 80% voltage closing capability.
2. Implement limit closing control utilizing the capabilities of the spring compensators on the Limitorque SB-00 operators.

3GM99
1. Change the operator from Limitorque SMB-00 to SB-00.
2. Implement limit closing control.

The repair for the 4 inch valves is still being evaluated.

If we can be of further service to you in this matter, please contact us.

Very truly yours,

G. K. Griffiths, Manager
Field Service - Southern Area
Nuclear Service Division

cc: J. T. Rhodes
E. A. Baum
L. M. Girvin
W. L. Stewart
C. W. Pennington
J. L. Wilson
W. R. Cartwright
V. W. Lockman

Westinghouse
Electric Corporation

[illegible]

February 19, 1981
VPA-81-11

Mr. B. R. Sylvia, Manager
Nuclear Operations and Maintenance
Virginia Electric and Power Company
P. O. Box 26666
Richmond, Virginia 23261

Dear Mr. Sylvia:

WESTINGHOUSE 3" AND 4" GATE VALVE CLOSURE PR[illegible]

The Westinghouse Safety Review Committee met on February 10, 1981 to review the problem of valve closure failure of Model 3GM39, 4GM37 and 4GM38. The committee decided that all utilities should be notified of the problem. The attachment amplifies and formalizes the verbal notification of U.S. plants on February 11, 1981.

For additional clarification please contact the undersigned.

Very truly yours,

George K. Griffiths

G. K. Griffiths, Manager
Southern Area

Attachment

cc: J. T. Rhodes
J. L. Wilson
J. L. Perkins
W. R. Cartwright
V. W. Lockman
E. A. Baum
L. M. Girvin
F. M. Milligood
G. E. Williams

In October 1980, Westinghouse informed the affected plants that plant pre-operational tests disclosed that Westinghouse Electro-Mechanical Division manufactured three inch gate valves, Model 3GM88, 1500 lb. class, failed to completely close under preoperational test conditions (i.e., approximately 2700 psid as flow approaches zero). These conditions were less severe than the equipment specification design conditions (i.e., 2750 psid as flow approaches zero). At that time, Westinghouse also reported that the later redesigned version of this valve, the Model 3GM99, may also be subject to the same problem, although no testing was performed on this model.

Westinghouse instituted an engineering investigation to determine the cause of the problem. Laboratory testing has verified that the Model 3GM99 will not close when subjected to the same preoperational test hydraulic conditions. These tests also showed that the problem is extended to the Westinghouse four inch Model 4GM87 and 4GM99.

The scope of supply for these valves is similar to that of the Model 3GM88. The majority have been supplied to Westinghouse nonoperating plants as part of the NSSS scope of supply while a smaller number have been sold directly by the Electro Mechanical Division to operating plants (both Westinghouse and non-Westinghouse) as spares or replacements.

Westinghouse has determined that, for nonoperating plants, several of these valves are classified as "active" (i.e., mechanical motion is required to perform a safety function). The functional requirements for "active" valves include closure under operating pressure/flow conditions. Since the subject valves are utilized in "active" applications on Westinghouse nonoperating plants, failure to completely close was considered reportable only on these nonoperating plants under title 10CFR50.55(e). Westinghouse will make no formal NRC notification of this problem.

It was determined, on Westinghouse nonoperating plants, that the functional requirement (pressure/flow) condition under which the valves must close may be significantly less than the preoperational test and equipment specification conditions under which the valves failed to close. Consequently, it is possible that complete closure of the subject valves may be accomplished under actual operating conditions even though complete closure was not accomplished under test conditions.

The affected valves can be identified by the yoke mounted nameplate. These nameplates are stamped "WESTINGHOUSE" and include "VALVE IDENT." and "VALVE I.D." numbers as shown in Table I. All nameplates have "VALVE IDENT." numbers, but those sold as spares or replacements may not have "VALVE I.D." numbers. The "VALVE IDENT." number includes the manufacturers model reference and the "VALVE I.D." number is a reference to the valve system application. The "VALVE I.D." number also appears on Westinghouse valve indexes and system flow diagrams. There is no reference to the "VALVE IDENT." number on these indexes or flow diagrams. Table I indicates the differential pressures for the various valves above which proper operation cannot be assured.

For operating plants, Westinghouse has insufficient information on the intended application or extent of functional testing performed on these valves since they were provided as spares or replacements. Therefore, in order for you to perform your own safety evaluation you should consider the following:

1. Have these valves been installed in your plant?

2. Have these valves been installed in a safety related system?

3. Is valve closure required to perform a safety related function?

4. Under what functional requirement operating conditions is valve closure required?

5. Has operational testing been performed to verify valve closure under the functional requirement operating conditions?

Listed below for your information is a summary of typical functional requirement information for various valve applications in Westinghouse nonoperating plants. This information is provided to assist you in determining your actual functional conditions.

System	Valve Function	Maximum $\overline{\Delta P}$ (psi) as Flow Approaches Zero	
		Equipment Specification	Functional Requirement
CVCS	Charging Line Isolation	2750	2700
CVCS	Chg. Pump Miniflow Isolation	2750	2700
CVCS	Letdown Line Containment Isolation	2750	600
CVCS	Letdown Line Isolation	2750	2250
ECCS	Boron Injection Tank Isolation	2750	1200
ECCS	Hot Leg Recirculation Iso.	2750	1200
ECCS	Cold Leg Recirculation Iso.	2750	1200

The engineering valve test program was comprised of a series of flow tests performed in a hydraulic test laboratory using a centrifugal charging pump to provide flow and pressure. These tests consisted of 75 to 100 closing and opening cycles against flows and pressures as high as 600 gpm and 2600 psid, respectively. These cycles provided the expected valve seat to disk wear which resulted in stabilized valve closing loads. Once the stabilized level was reached, closing tests were run at lower flows and differential pressures to determine the extent of the closure problem.

Modifications for the three inch valves have been qualified by testing. These modifications are as follows:

3QMB3 - 1. Change the operator gear ratio to insure 80% voltage closing capability.

2. Implement limit closing control utilizing the capabilities of the spring compensators on the limitorque SB-00 operators.

3QV83 - 1. Change the operator from limitorque SMB-000 to SB-00.

2. Implement limit closing control.

The repair for the four inch valves is still being evaluated.

As additional information concerning this problem becomes available you will be notified accordingly.

TABLE 1

NOMINAL VALVE SIZE (IN)	WEMD MODEL REFERENCE	"VALVE IDENT." (1)	"VALVE I.D." (2)	ΔP (PSID) BELOW WHICH VALVE WILL CLOSE (AS SHIPPED)
3	3GM88	03000GM88	3GM58 or 3GM78 or 3GM88	1500
	3GM88	03002GM88	3GM58 or 3GM78 or 3GM88	1500
	3GM99	03001GM99	3GM58 or 3GM78 or 3GM88	750
4	4GM88	04000GM88	4GM78 or 4GM88	750
	4GM88	04002GM88	4GM78 or 4GM88	750
4	4GM87	04000GM87	4GM77	750
	4GM87	04002GM87	4GM77	750

NOTES:

(1) This number found on the yoke mounted nameplate. This number occupies the first nine positions of a 24 position number. This number to be used in evaluating functional ΔP requirements.

(2) This number found on the yoke mounted nameplate. This number occupies the first three positions of a six position number. Valves sold as spares or replacements may not contain this number.