Docket File

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

May 11, 1992

Docket Nos. STN 50-456, STN 50-457
STN 50-454, STN 50-455,
50-237, 50-249, 50-373,
50-374, 50-254, 50-265,
and 50-295, 50-304

LICENSEE: Commonwealth Edison Company

FACILITY: Braidwood Units 1 and 2; Byron Units 1 and 2; Dresden Units 2 and 3; LaSalle Units 1 and 2; Quad Cities Units 1 and 2; and Zion Units 1 and 2

SUBJECT: SUMMARY OF MEETING HELD ON APRIL 8, 1992, WITH COMMONWEALTH EDISON REPRESENTATIVES TO DISCUSS MOTOR-OPERATED VALVE PROGRAM

On April 8, 1992, NRC staff from Region III, EMEB/NRR, and NRR Projects met with representatives of Commonwealth Edison (CECo) to discuss the progress of CECo in developing its program to resolve concerns regarding the performance of motor-operated valves (MOVs) at the CECo facilities. After meeting with the NRC staff in July 1990 and the discovery of MOV design problems at Byron/Braidwood stations, CECo had submitted a response to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," in September 1990. Based on that submittal and an NRC inspection at the Byron station in January 1991, the NRC staff was optimistic that CECo would be able to resolve the MOV issue for its facilities consistent with the intent of GL 89-10. However, during subsequent inspections at Dresden, Quad Cities, and Braidwood, Region III inspectors found that CECo appeared to be making little progress in resolving some of the concerns raised by the staff regarding the licensee's MOV program. Therefore, the staff had requested CECo to meet to discuss its MOV program. The meeting participants are listed in Enclosure 1.

At the April 8 meeting, the staff and CECo discussed several specific concerns regarding the CECo MOV program and the licensee's plans for resolving the concerns. The licensee presented a package, "Implementation of Generic Letter 89-10 Program" for the discussions, which is attached as Enclosure 2. At the conclusion of the meeting, CECo committed to submit its proposed resolution including scheduled completion dates. Below, the staff summarizes the more significant issues and its preliminary views pending the CECo submittal:

1. The staff determined at the EDSFI at Dresden that CECo was not assuming the degraded grid setpoint in its electrical calculations, but rather was assuming a reliable offsite power level. CECo is currently updating its calculations for all electrical equipment with completion planned for August 1992. CECo stated that the calculations for Dresden had been completed with little effect on the capability of the MOVs. The staff encouraged CECo to sample check any MOVs considered to be significantly affected by the new calculations as soon as possible.

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Memo & ltr

2. The staff determined during the inspections that CECo had modified the standard thrust equation for globe valves in a less conservative direction. The licensee agreed to review its globe valve test data to validate its modified thrust equation for globe valves.

3. The staff found during the inspections that the licensee was assuming values for stem friction coefficient without fully justifying those assumptions. This was of particular concern because of the licensee's use of a 36-month stem lubrication frequency for some MOVs. The licensee is planning to sample some MOVs in an effort to validate its stem friction coefficient assumptions. The unique behavior of MOVs may affect the licensee's ability to use only a sample to validate its assumptions. The licensee will also need to validate its assumptions over the entire stem lubrication interval.

4. The staff found during the inspections that the licensee was not planning to follow the two-stage approach of GL 89-10 that relates to MOVs for which testing under design-basis differential pressure conditions is not practicable. Rather than testing those MOVs under maximum achievable conditions as discussed in Supplement 1 to GL 89-10, the licensee would only dynamically test the MOVs if greater than 90% differential pressure could be achieved. The licensee stated that it did not want to dynamically test MOVs unless it could reliably extrapolate the results to design-basis conditions. In GL 89-10 and supplements, the staff recommended testing under maximum achievable conditions in order to help validate the valve factor, stem friction coefficient and other assumptions even though the results may not be fully representative of design-basis performance. At the meeting, the licensee indicated that the MOVs that could be tested above static conditions but at less than 90% full differential pressure represented a small portion of total MOVs to be tested. The staff might withhold a final decision on the need to test the remaining MOVs at less than 90% full pressure until the licensee evaluates the results of the tested MOVs.

5. The staff raised concerns during the inspections with respect to the licensee's post-maintenance testing methods. The licensee presented its preliminary results of a study of motor current and power factor in determining the effects of valve packing adjustments.

6. The staff has concerns that CECo has not been evaluating its test data to validate the assumptions in its MOV sizing and switch setting calculations. These assumptions include valve factors, stem friction coefficients, and rate of loading effects. At the meeting, CECo stated that dynamic tests of 80 MOVs had recently been conducted during the current outages. The licensee agreed to review the test data to begin validating its assumptions. The licensee will be expected to take action to modify its assumptions as necessary and to evaluate any effects on operability for MOVs sized and set using those assumptions.

Region III and NRR personnel will review the plans and schedule to be provided by CECo to determine whether the licensee will be able to resolve the MOV issue at the CECo facilities in a timely manner.

Original signed by:
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Enclosures:
As stated

cc: See next page

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Enclosure 1

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MOV MEETING AT REGION III
APRIL 8, 1992

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Mark Ring	Chief, Engineering-RIII
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T. Sullivan	EMEB/NRR/NRC
B. Rybak	CECo/M&S-D
Mike Reed	CECo/NED-E/I&C
Darrell Taylor	CECo/ENC-RA
Brad Adams	CECo/EMC-RA
Robert J. Ungeran	CECo/NED-M/S Design Group
Robert Branson	CECo NED-M&S
Terrence W. Simpkin	CECo-Braidwood Licensing Admin
Marcia Jackson	CECo-Generic Issues Admin
Edward Fuerst	CECo-Nuclear Operations
David Pool	PRC Engineering/NED
Chris Bedford	CECo-Braidwood Tech Staff
William Cote	CECo Braidwood MOV Coordinator
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George P. Wagner	CECo Nuclear Eng Mgr
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G. Replogle	NRC, RIII, DRS
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H. L. Muldering	CECo-NED
M. J. Farber	NRC, RIII, DRP
V. P. Lougheed	NRC, RIII, DRP
Ron Gardner	NRC, RIII, DRS
Dave Butler	NRC, RIII, DRS

Enclosure 2

Commonwealth Edison Company

Implementation of Generic Letter 89-10 Program

NRC Presentation
Region III Headquarters
April 8, 1992

This Presentation Will Address the Following NRC Questions

1. **What is CECo's resolution of the degraded voltage issue that was raised during the Dresden EDSFI with regards to impact on MOV operability?**

2. **What is CECo's justification for the use of a 0 line pressure for thrust calculations on Globe Valves?**

3. **What is CECo's justification for the use of a stem friction factor coefficient of 0.15 on certain MOVs?**

4. **What is the justification for CECo's 36 month stem lubrication frequency in light of the recommendation from Limitorque of an 18 month frequency?**

5. **What are CECo's plans for post maintenance testing after packing adjustments are made to MOVs?**

6. **NRC expressed concern that we are not using our own test data to validate our program and justify our assumptions.**

7. **The NRC is concerned that we are backing off of our commitment for dP testing and our definition of the 2-stage approach does not match what is presented in GL 89-10 and supplements.**

Agenda

I. Introduction:

   a. Overview of CECo's MOV Program progress.

   b. CECo's significant MOV Program initiatives.

II. CECo's resolution of the Degraded Voltage Issue raised during the Dresden EDSFI and the relationship to MOV operability. (Q.1)

III. Justification for the use of 0 psi Line Pressure for thrust calculations of globe valves. (Q.2)

IV. CECo's validation of design assumptions using GL 89-10 Program test data, including feedback mechanisms (Q.6):

   a. Justification for CECo's use of a stem friction coefficient equal to 0.15 for certain MOVs. (Q.3)

   b. Justification for CECo's current stem lubrication interval of 36 months. (Q.4)

   c. CECo's plans for post maintenance testing of packing adjustments. (Q.5)

V. CECo's dynamic (dp) testing program: (Q.7)

   a. Objective of CECo's MOV dP testing program.

   b. CECo's commitment for dP testing.

   c. MOV dP testing summary breakdown.

   d. Validation of MOVs not dP tested.

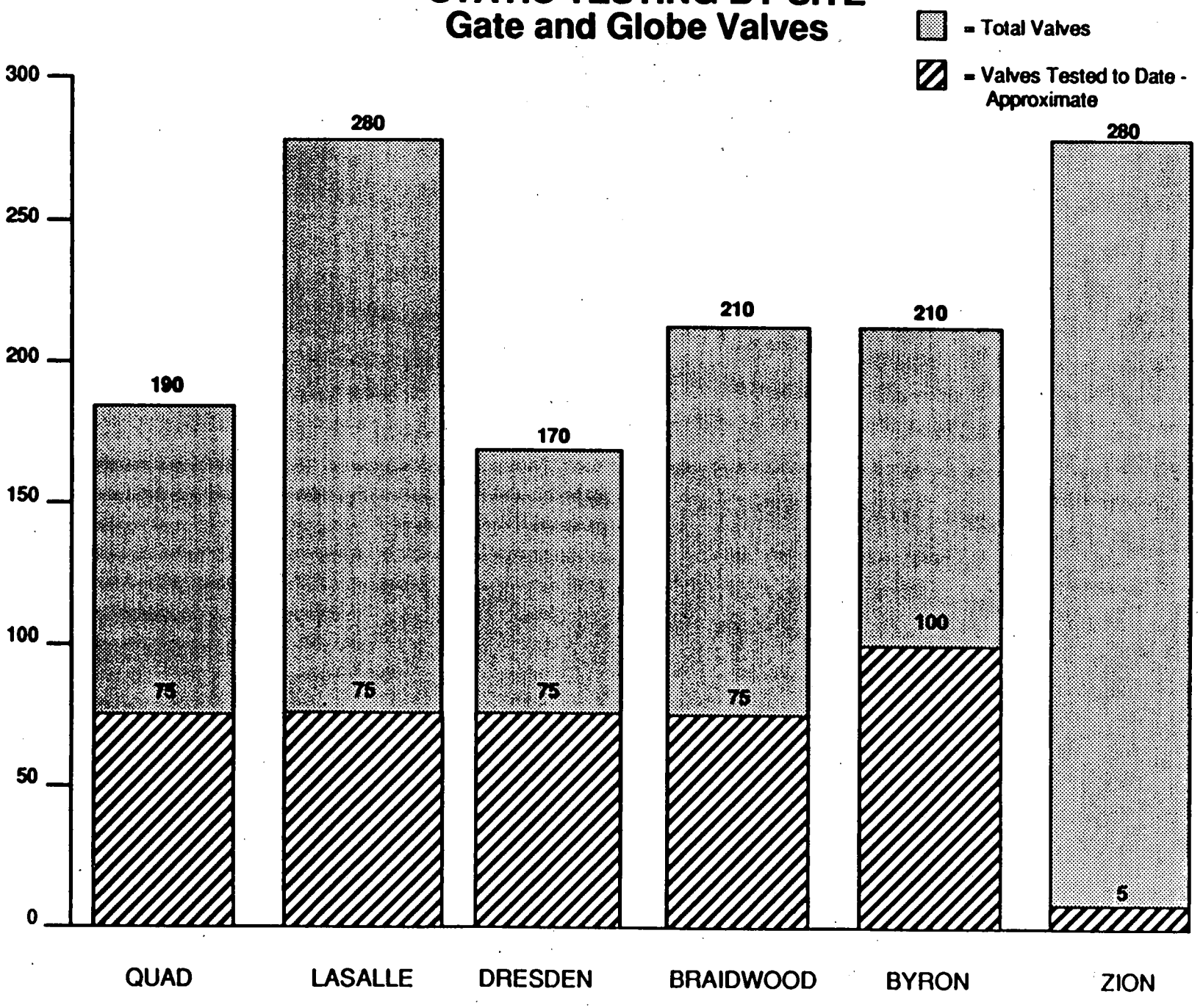
VI. Conclusions.

I. Introduction

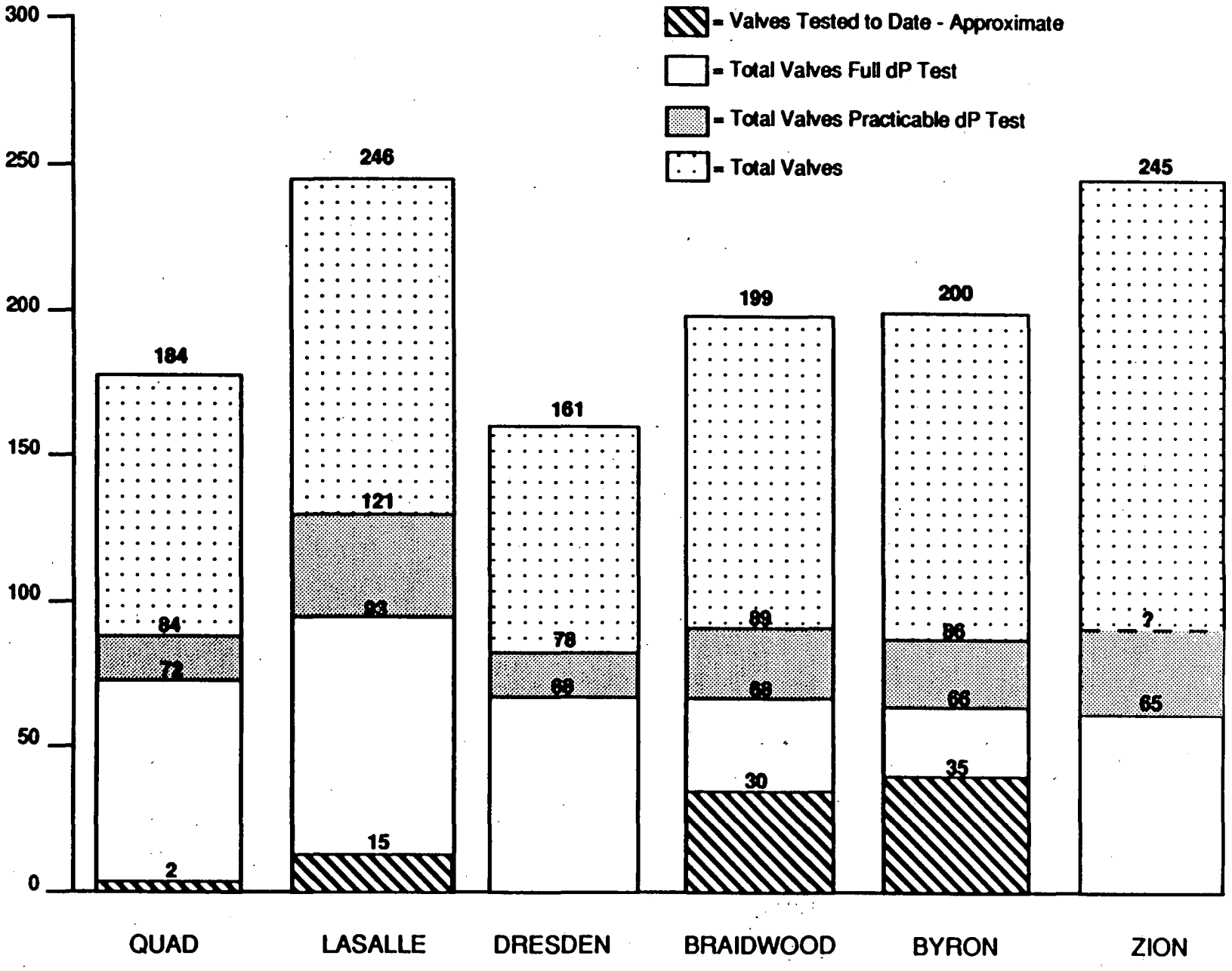
I.a Overview of MOV Program Progress

- **Scope of program includes approximately 1540 MOVs**
  - 963 Gate Valves
  - 378 Globe Valves
  - 195 Butterfly Valves
- **All design basis reviews are complete. All calculations are complete except for torque calculations on Butterfly valves.**
- **Static diagnostic testing has been performed on approximately ~~450~~ 405 MOVs.**
- **Dynamic (dP) diagnostic testing has been performed on approximately 80 MOVs.**
- **Four NRC inspections of GL 89-10 Program have been performed.**

STATIC TESTING BY SITE
Gate and Globe Valves



dP TESTING BY SITE
Gate and Globe Valves



* Meaningful Static Tests Total 107 MOVs Which Are Not Included in These Totals

I.b CECo's Significant MOV Program Initiatives

- **Inertia Loads**
  - Inertia loads are taken into account in the thrust window calculations to prevent exceeding structural limits on actuators & valves.

- **Un-Wedging Loads**
  - Ensure sufficient thrust to unseat valve. Note that both inertial and unwedging loads are evaluated to verify original design assumptions.

- **Stem Lubrication Degradation**
  - Taken into account in our thrust window calculations.

- **Kalsi Thrust Rating Increase Program**
  - CECo is one of the primary sponsors of the program. Program validates the thrust capability of an actuator.

- **Inertia loads, un-wedging loads, and stem lubrication degradation noted as industry deficiencies in NRC Information Notice 92-17.**

- **Note that CECo's older stations are refurbishing all Limitorque Actuators prior to baseline testing.**

II. CECo's Resolution of the Degraded Voltage Issue

- In mid 1990, in response to GL 89-10, CECo made an engineering decision to evaluate safety related MOV operability using Reliable Offsite Power Voltage Levels.

- Reliable Offsite Power Levels defined as switchyard voltage seen by the stations assuming system electrical load 5% above CECo's all-time peak load and a concurrent double contingency failure on CECo's T & D system.

- CECo has demonstrated MOV operability using the design basis of Reliable Offsite Power Levels for degraded voltage situation.

- Issue raised during Dresden EDSFI as to whether the second-level undervoltage (degraded voltage) setpoint was sufficient to ensure adequate voltage to operate all Class 1E equipment, including safety related MOVs.

- CECo is evaluating the degraded voltage setpoint for all 6 nuclear stations by performing revised critical voltage calculations for each station. Revision of these calculations is a large effort requiring approximately 42,000 person-hours and $3 million in resources to generate the analyses.

- Until the calculations are completed for each station, CECo has no evidence that this issue impacts the operability of any safety related equipment, including MOVs.

- Interim compensatory actions, as necessary, are being implemented as the calculations are completed to ensure operability.

- Longer term actions may include facility modifications to resolve any noted problems.

III. Use of 0 Line Pressure for Globe Valves

- Thrust = dP Load + Packing Load + Stem Load; Eq. 1

- Stem Load portion of Eq. 1 is where CECo inputs 0 Line Pressure.

- Stem Load

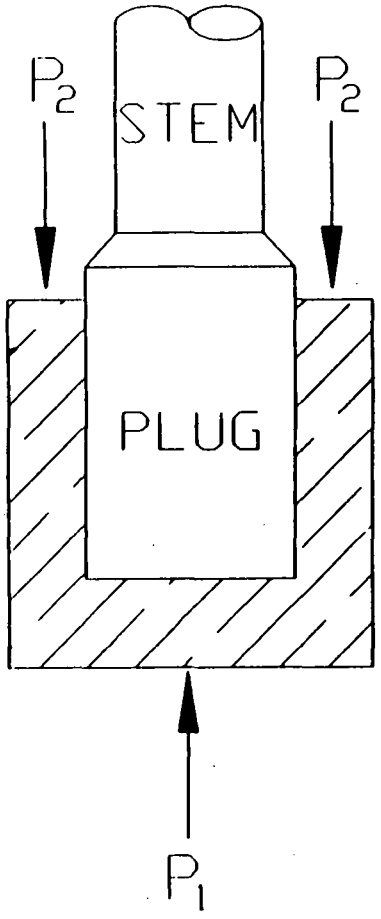
  - Actual Conditions => Area(stem) * (P_{sys} - dP VF) Eq. 2
  - CECo Calculation => Area(stem) * (P_{sys} = 0) Eq. 3
  - NRC Position => Area(stem) * (P_{sys} - dP) Eq. 4

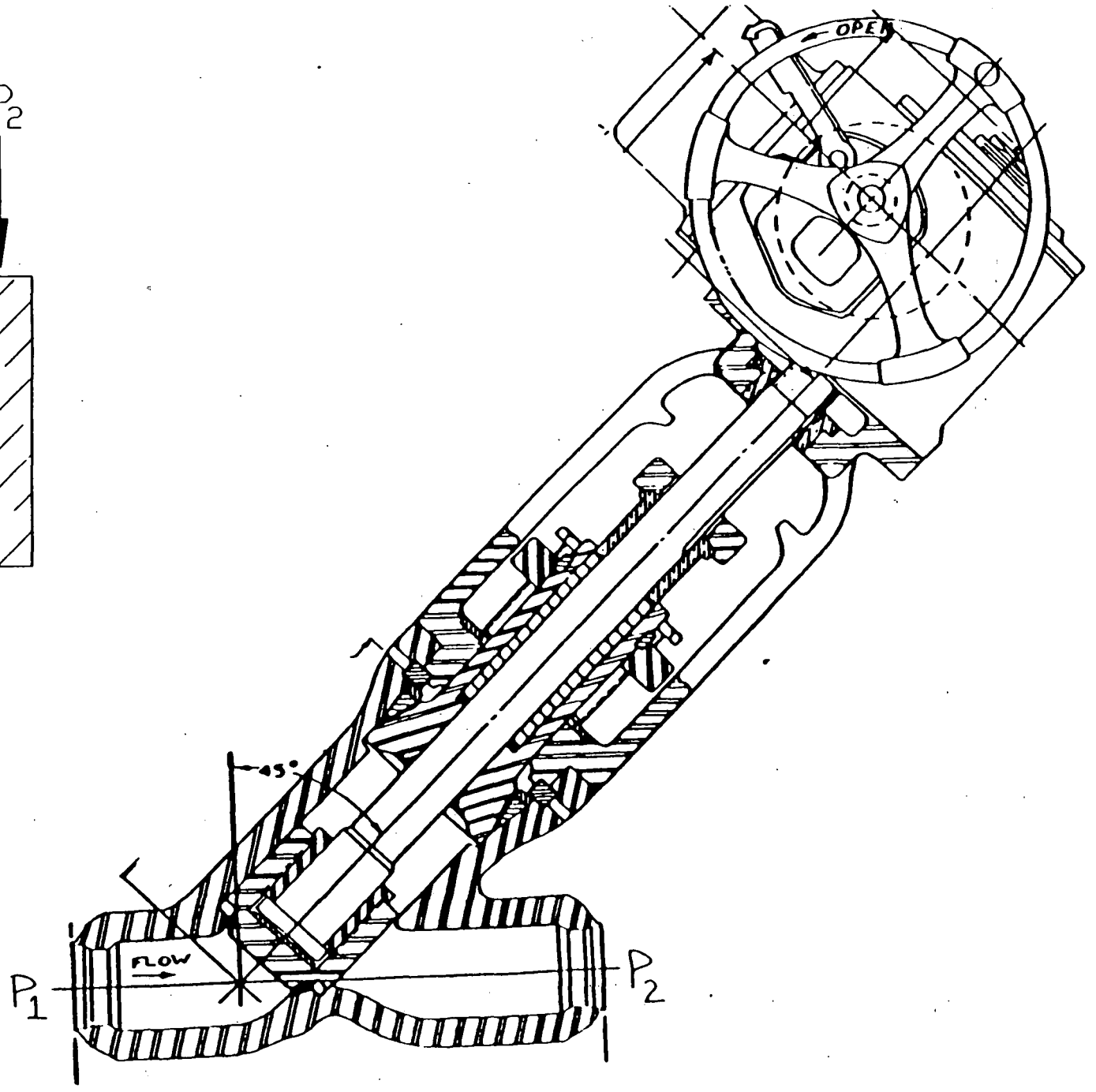
- CECo's calculation (Eq. 3) is conservative with respect to actual conditions (Eq. 2) because Eq. 2 can be negative which would have the net effect of decreasing the required thrust calculation determined in Eq. 1.

- CECo has evaluated our position (Eq. 3) versus the NRC's position from the Braidwood MOV inspection (Eq. 4) and found the worst case difference in thrust calculations to be only 103 pounds force. CECo feels that the use of Eq. 4 for the stem load portion of the thrust calculation is an unnecessary conservatism with negligible impact on the final results.

- Note that Limitorque guidance ignores Stem Load portion of Eq. 1 for system pressures < 500 psig. CECo's position is conservative with respect to this guidance because we consider stem rejection load in the thrust evaluations in the dP Load portion of Eq. 1.

- CECo does not plan to change the current methodology for calculating required thrust values for Globe valves. CECo's overall calculations are conservative and bound expected conditions.


P2
STEM
P2
PLUG
P1


OPEN
45°
FLOW
P1
P2

IV. CECo's Validation of Design Assumptions

a. Justification for CECo's use of a stem friction coefficient = 0.15 for certain MOVs.

b. Justification for CECo's current stem lubrication interval of 36 months.

c. CECo's plans for post maintenance testing of packing adjustments.

IV.a Justification for CECo's Use of a Stem Coefficient = 0.15

Basis

o	- Westinghouse:	Test Results: 0.06 to 0.11, Used: 0.15
	- Rotork:	Test Results: 0.074 to 0.133, Used: 0.14
	- Anchor Darling:	Used: 0.15
	- KALSI Engineering	Test Results: 0.08 to 0.14
	- INEL Blowdown Testing:	Test Results: 0.1 to 0.15 ("0.15 Coeff. of Friction Conservative")
	- EPRI Prelim Testing:	Test Results: 0.01 to 0.16

- Based on the above data, it is apparent that values for stem friction coefficients better than 0.2 are acceptable for certain MOVs.

- CECo uses a friction coefficient = 0.20 for all MOVs except for approximately 300 Westinghouse MOVs and a limited population of approximately 40 blowdown valves.

- There is a Limitorque recommendation on stem friction coefficients that values < 0.20 can be justified.

- EPRI evaluation of industry stem friction coefficients is due to be completed by the end of 1992. CECo expects that the final results of the EPRI work will validate our assumptions on stem friction coefficients.

IVa. Stem Friction Coefficient (cont.)

CECo's Validation

- CECo will validate our stem friction coefficient generic design assumptions using limited as left VOTES Test Cartridge (VTC) data. This limited VOTES testing will include approximately 10 VTC tests per station.

- CECo does not believe that validation of stem friction coefficients based on Generic Spring Pack Curves/Torque Switch Settings is appropriate on an individual MOV due to the overall uncertainties in the calculations attributable to items like inaccuracy in reading of the torque switch settings, inaccuracies in the generic curves, and balance of the torque switch.

IVb. Lubrication Degradation 36 Month Interval

Basis

- CECo's methodology for using stem coefficient of friction factors accounts for degradation of stem conditions for both 18 month and 36 month lube intervals.
- Oak Ridge National Laboratory found a 17% reduction in thrust after 165 valve cycling actions.
- KALSI reported stem friction factors stayed constant over several hundred cycles with values between 0.08 and 0.14.
- Limited Westinghouse testing indicated little change in stem friction factors after 60 valve cycling actions.

CECo's Validation

- Select as found testing program is ongoing at Quad Cities Station to quantify the stem lubrication degradation.
- EPRI Test Program to be completed by end of 1992 which will provide further evidence/justification for the use of particular stem friction factors and degradation of stem lubrication over time.
- CECo commits to adjust our Lubrication Program, as necessary, based on the results of the Quad Cities testing and EPRI Program final results.

IVc. Plans for Post Maintenance Testing of Packing Adjustments

Position

- **CECo's utilizes current signature traces to assess the impact of packing adjustments on MOV performance.**

CECo's Validation Efforts

- **CECo is investigating the relationship, both analytically and through testing, between change in motor torque and current/power factor changes.**
- **CECo will reassess the present post maintenance testing program based on the results of these investigations by 9/30/92.**
- **Among the alternative processes currently being considered:**
  - Live Load/Engineered Packing
  - Portable Strain Gauge Testing
  - Larger Margins in Thrust Windows
  - VOTES Testing
  - Procedural Controls

V. CECo's Dynamic (dp) Testing Program

a. Objective of CECo's MOV dp Testing Program.

b. CECo's Commitment for dP Testing.

c. MOV Testing Breakdown.

d. Validation of MOVs not dP Tested.

Va. Objectives of CECo's dP Testing Program

- **Establish a dP testing program that assures operability of CECo's safety related MOVs.**
- **Establish and implement criteria for determining which MOVs are dP tested.**
- **Focus CECo's corporate engineering efforts to provide sound justification to ensure operability of MOVs that are not dP tested.**

Vb. CECo's Commitment for dP Testing

- **CECo will perform full dP testing on approximately 430 MOVs at our 6 stations (30% of CECo's total GL 89-10 MOV population).**

- **NRC economic analysis justifying the GL 89-10 program assumed that dP testing would be performed on 10% of the total GL 89-10 population.**

- **CECo intends to test practicable MOVs where testing can be performed at or near design basis conditions.**

- **CECo has split "practicable" into two parts:**

  - Practicable = > No T.S. violations, unusual alignments, etc.

  - Meaningful = > Static tests same as dP test, i.e. dynamic load portion of thrust is less than 10% of total thrust requirement.

- **CECo's definition of "at or near design basis conditions" is:**

  - MOVs at > 90% design basis conditions (dbc).

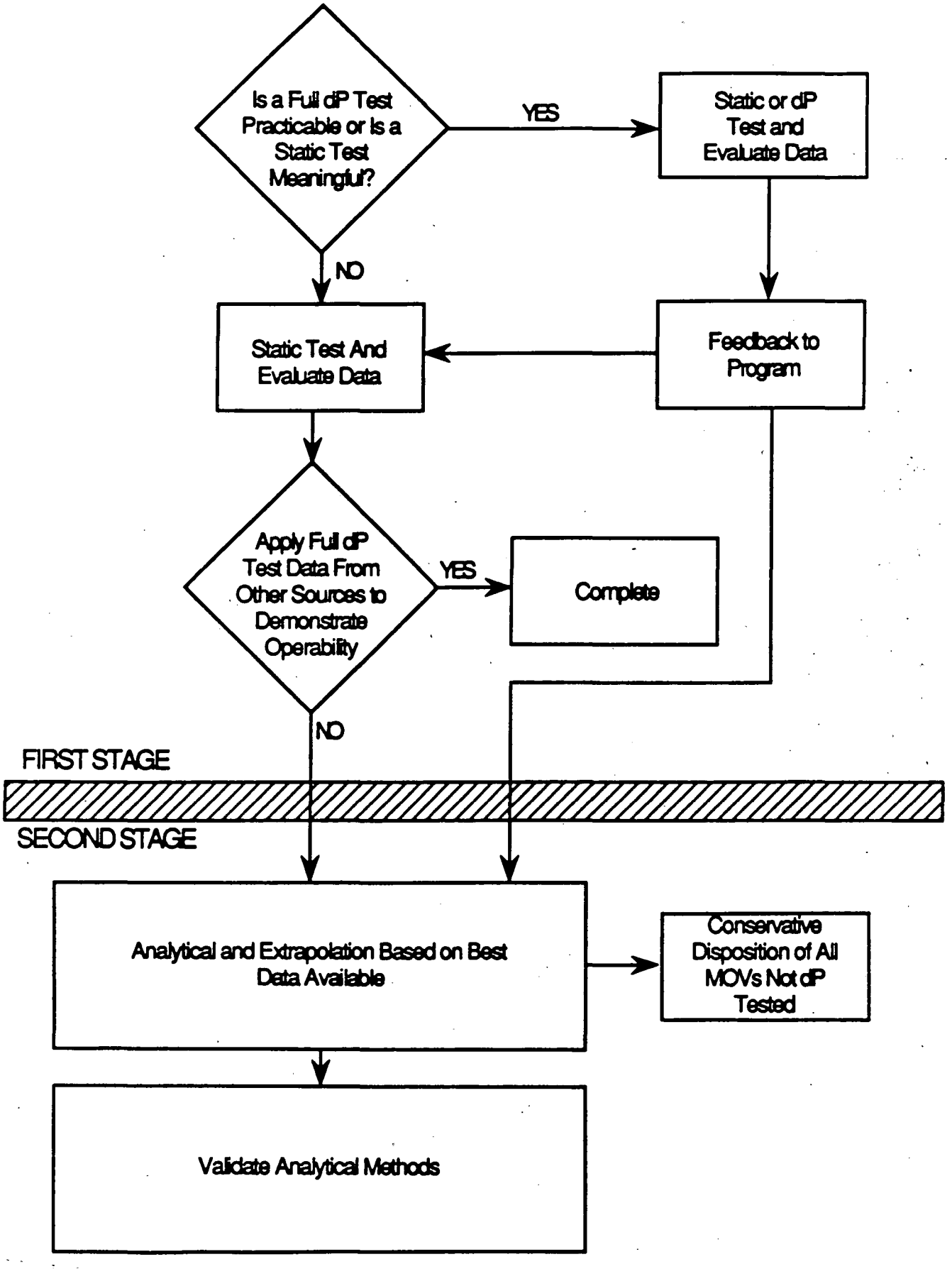
  - Certain MOVs between 80 - 90% dbc, if extrapolation of test results to 100% dbc can be justified.

- **CECo's technical guidance from our industry experts demonstrates that established extrapolation techniques are only validated for the >90% dbc MOVs. CECo feels that we may be able to expand the population to include the 80-90% dbc MOVs without significant engineering analyses. However, CECo feels that the prudent application of our resources should be focussed on dP testing that we can properly justify, particularly based on the large % of MOVs that we are currently planning to dP test.**

Vb. CECo's Commitment for dP Testing (cont.)

- **MOVs in the GL 89-10 program that do not meet CECo's criteria for dP testing will be verified using a 2-stage approach.**

DP TEST PLAN


Is a Full dP Test Practicable or Is a Static Test Meaningful?
YES
Static or dP Test and Evaluate Data
NO
Static Test And Evaluate Data
Feedback to Program
Apply Full dP Test Data From Other Sources to Demonstrate Operability
YES
Complete
NO
FIRST STAGE
SECOND STAGE
Analytical and Extrapolation Based on Best Data Available
Conservative Disposition of All MOVs Not dP Tested
Validate Analytical Methods

Vc. MOV dP Testing Breakdown

- Approximate Summary Numbers*:

Total Gate & Globe Valves in GL 89-10 Program =>	1340
Total Butterfly Valves in GL 89-10 Program =>	195
MOVs that are "not practicable" - strict definition =>	602
MOVs that meet the "meaningful" static test criteria =>	107
MOVs that meet the "full dP test" criteria =>	431*
MOVs that do not meet the "full dP test" criteria =>	202

*Note: Above summary numbers subject to change pending completion of practicability reviews and GL 89-10 Supplement 4 evaluation. This review will be completed by September 30, 1992.

- CECo will perform full dP testing on approximately 431 MOVs at CECo's six nuclear stations. CECo feels that this amount of full dP testing will be more than sufficient to ensure operability of all of CECo's GL 89-10 MOVs.

- Currently, CECo has performed dP tests on 80 MOVs in the GL 89-10 program. Approximately 50 more dP tests are scheduled during the current Zion and Byron Station refueling outages.

Vd. Validation of MOVs Not dP Tested

- **In Supplement 1, the NRC recognized that a technical basis can be established for verifying MOV capabilities without dP testing.**

- **CECo will prioritize the verification of MOVs that are not dP tested based on the following considerations:**

  - design margin
  - dP magnitude, i.e. % of design basis conditions
  - CECo/industry experience
  - MOV function, i.e. safety significance

- **CECo will utilize grouping only where justified and documented.**

- **All MOVs That Cannot Be Full dP Tested Will Be Conservatively Dispositioned. Among the Factors To Be Considered in That Disposition Will Be:**

  - Rate of Loading
  - Valve Factors
  - Unwedging

VI. Conclusions

- CECo believes that it's implementation of the GL 89-10 program is conservative with respect to the requirements of the generic letter and the overall effort of the industry. In addition, CECo is witnessing an overall improvement in MOV performance as evidenced by the improving failure ratio.

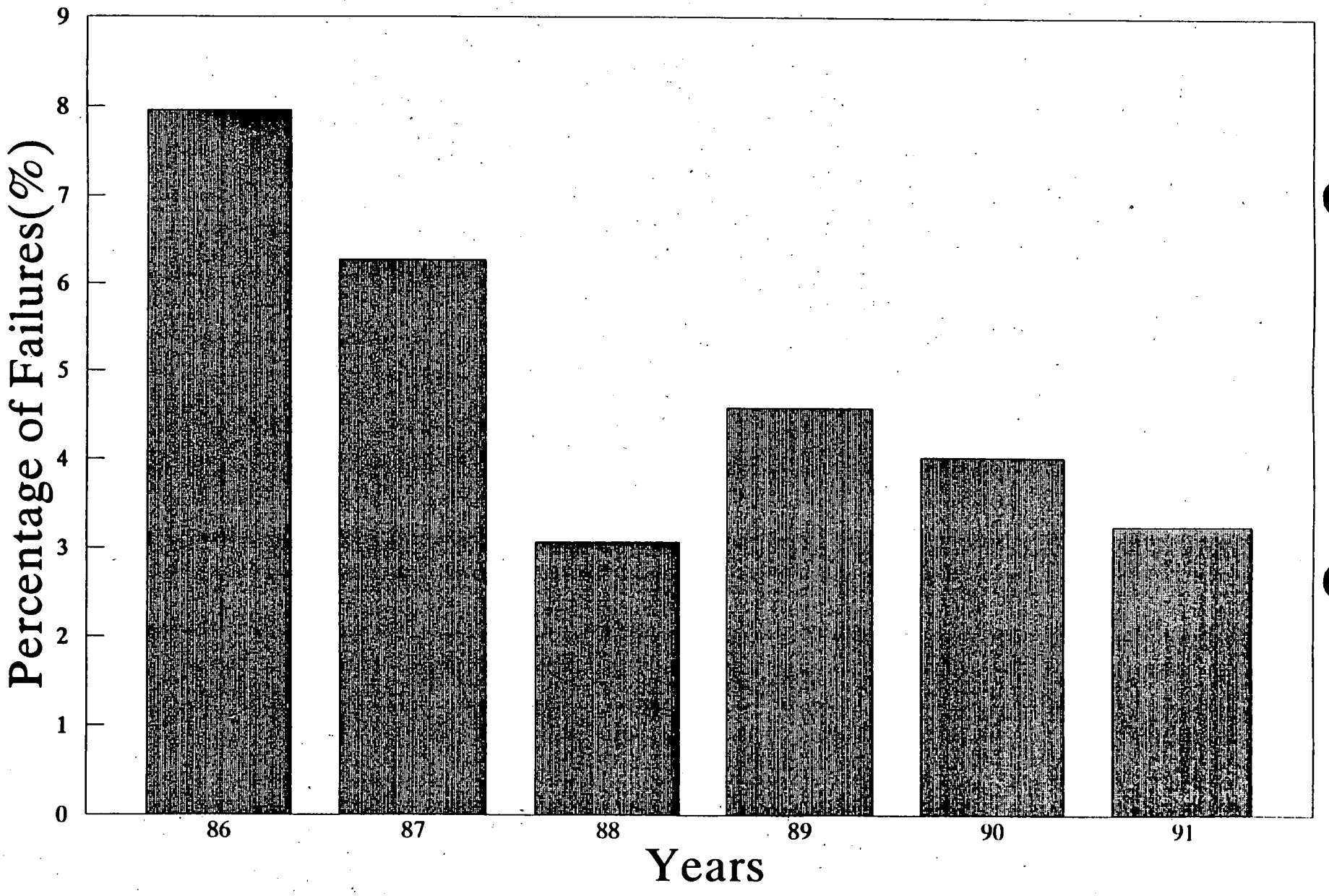
- CECo is continuing to accumulate and evaluate test data to validate our analytic assumptions and to provide input to trending programs.

- CECo has seen few cases where detailed analyses of MOV operability have questioned the ability of our safety related MOVs to function.

- CECo's design basis reviews have shown that we have a great deal of margin in a large percentage of our GL 89-10 MOVs.

- CECo feels that generic operability concerns for our safety related MOVs are not justified and that continuation of CECo's current methodical approach in the implementation of the requirements of GL 89-10 is appropriate.

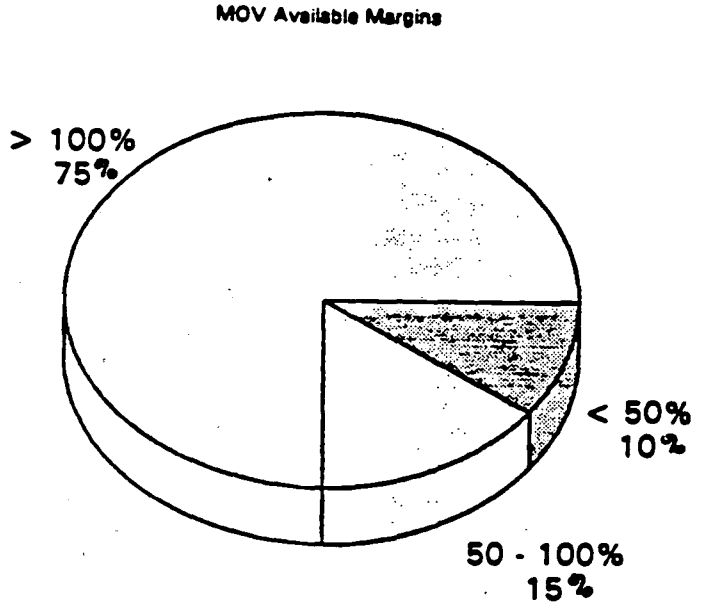
NPRDS FAILURE DATA



Available Margins

Maximum Allowable Thrust

- o Structural or Actuator Limits
- o Spring Pack Limits
- o Motor Gearing Capability
- o Inertia & Unwedging



% Margin

- o Lubrication Degradation
- o Equipment Inaccuracy

Required Minimum Thrust

- o Pressure Load (dp, VF)
- o Packing Load
- o Piston Load