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

Docket File

AUG 7 1984

Docket No.: 50-423

Mr. William G. Counsil
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141-0270

Dear Mr. Counsil:

Subject: Information Request Related to Plant Site Audit for Seismic and Dynamic Qualification Review of Millstone 3

The NRC staff's Seismic and Dynamic Qualification and Qualification of Mechanical Equipment reviews consist of two parts. The first is the review of your general program described in the FSAR. The second is a detailed on-site audit of equipment as installed and the qualification documentation.

The enclosed information request is intended to provide the NRC staff with information concerning your progress in the equipment qualification program. Please submit your completed Master Equipment List, Enclosure 1, no later than six weeks before you have determined that you are prepared for the staffs audit and at least 85% of all safety related equipment has been installed and qualified. At the same time please send one copy of the appropriate part of your response to the staffs consultants.

Seismic Qualification

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Pump/Valve Operability

Mr. Bruce Miller
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For further information or clarification, please contact the Licensing Project Manager, Elizabeth L. Doolittle at (301) 492-4911.

Sincerely,

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosures:
1. Master Listing of Seismic and Dynamic Qualification and Notes
2. Seismic and Dynamic Qualification Summary of Equipment
3. Pump and Valve Operability Assurance Review
4. Operability Qualification of Purge and Vent Valves
5. Guidelines for Demonstration of Operability of Purge and Vent Valves

cc: See next page

CONCURRENCES:

DL:LB#1	DL:LB#1
ELDoolittle:es	BJYoungblood
8/7/84	8/7/84

DIST:
Docket File
NRC PDR
Local PDR
PRC System
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cc: See next page

MILLSTONE

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ENCLOSURE
INFORMATION REQUEST RELATED TO
EQUIPMENT QUALIFICATION REVIEW
MILLSTONE NUCLEAR POWER STATION, UNIT 3
DOCKET NO. 50-423

To confirm the extent to which safety-related equipment meets the requirements of the General Design Criteria (GDC) of 10 CFR Part 50, the NRC staff, assisted by Technical Assistance Contractors, will conduct a plant site audit and review. It is our intent to conduct a plant specific on-site Pump and Valve Operability Review Team (PVORT) audit concurrent with the Seismic Qualification Review Team (SQRT) audit. We believe such scheduling should minimize manpower and scheduling conflicts for the applicant, the NRC staff, and our technical assistance contractors.

Since the site audit is performed on a sampling basis it is necessary to ensure that 85 to 90 percent of the safety related equipment are qualified and installed before the audit. In order that the staff is familiar with the seismic and dynamic qualification programs currently being conducted, it is requested that all test programs be identified by submitting a brief description of the program, items being tested, the vendor or the testing laboratory involved, and the dates and location of the tests. Information about the ongoing test programs should be submitted as soon as possible so that the NRC staff can review and witness relevant tests for selected items.

A list of all safety-related equipment should be provided so that an assessment of the equipment qualification status can be made by the staff. Equipment should be divided first by system then by component type. Attachment #1 shows a tabular format which should be followed to present the status summary of all safety-related equipment.

After the information on Attachment #1 is received, and it is determined that the equipment qualification is substantially complete, selections will be made of the equipment to be audited, and reviewed, by the SQRT and PVORT. Specific information on equipment selected for audit by each review team will be requested. The information that will be requested for those equipment selected by the SQRT is shown in Attachment #2. The information that will be requested for those equipment selected by PVORT is shown in Attachment #3. In addition, the applicant will be requested to provide a complete set of floor response spectra identifying their applicability to the equipment listed in Attachment #1.

For the equipment selected by the SQRT for audit, the combined Required Response Spectra (RRS) or the combined dynamic response will be reviewed. The SQRT will examine and compare the equipment on-site installation v/s the test configuration and mounting, and determine whether the test, or analysis which has been conducted conforms to the applicable standards and agrees with the RRS. In cases where the plant is a BWR facility, the equipment qualifying documentation must also provide evidence that the hydrodynamic loads in the (0 - 100) Hz frequency range have been accounted for.

For the equipment selected by the PVORT for audit, the applicant must provide evidence that appropriate manufacturers' tests have been conducted, reviewed, and approved, and that the equipment meets, or exceeds the design requirements. The applicant must also provide qualification test and or analysis results that provide assurance that the equipment will operate (function) during and following the Design Basis Events (DBE) and all appropriate combinations thereof.

The specific information requested in Attachments #2, and #3 should be provided to the NRC staff two weeks prior to the plant site visit. The applicant should make available at the plant site all the pertinent documents and reports of the qualification for the selected equipment. After the visit, the applicant should be prepared to submit certain selected documents and reports for further staff review. The purpose of the audits is to confirm the acceptability of the qualification procedures, and implementation of the procedures to all safety-related equipment based on the review of a few selected pieces. If a number of deficiencies are observed or significant generic concerns arise, the deficiencies should be removed for all equipment important to safety subject to confirmation by a follow-up audit of randomly selected items before the fuel loading date.

The site audits will also include a review of the extent to which the documentation of equipment qualification is complete. The acceptance criteria for requirements on records is provided in Section 3.10 of the Standard Review Plan Revision 2 (NUREG-800).

Another element of the seismic and dynamic qualification review deals with the containment isolation valves for the purge and vent systems to assure their ability to close against postulated accident pressure inside containment. Information needed for this review and the basis for the review are provided in Attachments 4 and 5.

ATTACHMENT #1

- MASTER LISTING OF SEISMIC AND DYNAMIC QUALIFICATION SUMMARY AND STATUS OF SAFETY-RELATED EQUIPMENT

- ASSOCIATED EXPLANATORY NOTE

MASTER LISTING OF SEISMIC AND DYNAMIC QUALIFICATION SUMMARY AND STATUS OF SAFETY RELATED EQUIPMENT

PLANT NAME: DOCKET NO: UTILITY: A/E: NSSS:

FOR EQUIPMENT LISTED BELOW

THE SUPPLIER IS: A/E ☐, NSSS ☐, OTHER ☐. SAFTY SYSTEM & FUNCTION ARE:

DENT NO.	EQUIPMENT				LOCATION		LOADS CONSIDERED			QUALIFICATION METHOD			LOWEST NATURAL FREQUENCY			STATUS		RRS	CODES AND STANDARDS
	TYPE AND DESCRIPTION	MANUFACTURER AND MODEL NO.	TEST REPORT NO.	QUANTITY	BUILDING AND ELEVATION	MOUNTING	SEISMIC	OTHER DYNAMIC	READ-INPUT (ZPA)	ANALYSIS	TEST FREQUENCY	TEST DIRECTION	F/B (HZ)	S/S (HZ)	V (HZ)	QUALIFICATION	INSTALLATION	REF	

NOTES TO MASTER LISTING

(1) The information on Plant Name, Docket No., etc., are pertinent to the power station and will be the same for all sheets.

(2) The equipment is listed by supplier (circle one after "SUPPLIED BY:") and by system (indicate name and function of system after "SYSTEM AND FUNCTION:"). Typical safety systems, for example, are Engineered Safeguard Actuation, Reactor Protection, Containment Isolation, Steamline Isolation, Main Feedwater Shutdown and Isolation, Emergency Power, Emergency Core Cooling, Containment Heat Removal, Containment Fission Product Removal, Containment Combustible Gas Control, Auxiliary Feedwater, Containment Ventilation, Containment Radiation Monitoring, Control Room Habitability System, Ventilation for Areas Containing Safety Equipment, Component Cooling, Service Water, Emergency Systems to Achieve Safe Shutdown, Postaccident Sampling and Monitoring, Radiation Monitoring, Safety-Related Display Instrumentation. The supplier will usually be either A/E or NSSS. Use separate sheets for each system. Use additional sheets when a given system has more equipment than can be listed on one sheet.

(3) "IDENT. NO." is to be filled in by the organization preparing the list. Each equipment listed should have separate identification number. The following form is recommended:

(a) For A/E supplied equipment, the number may be "BOP-XXX." If more than one group is preparing forms, the number may be "BOP-M-XXX" (Mechanical) or "BOP-IC-XXX" (Instrumentation and Control).

(b) For NSSS supplied equipment, the number may be NSSS-M-XXX, NSSS-IC-XXX, etc.

(c) The number written on each line (for each listed equipment) should be an ordered numeric listing for the above indicated-XXX (-001 through completion). These numbers need not follow in order for each system (-002 and -004 may be with one system, but -003 may be with another system).

(d) Inside the parenthesis should be the "BOP-M," "NSSS-IC," etc.

(4) The "TYPE" refers to its generic name, such as pressure transmitter, indicator, solenoid value, cabinet, etc. Equipment type should be described by indicating for example, motor driven pump, turbine driven pump, motor operated valve, air operated valve, 18" valve, etc. Following abbreviations can be used where appropriate.

Valves:
BV - Ball valve, BFV - Butterfly valve, CV - check valve, DV - Diaphragm valve, GV - Gato valve, GLV - Glove valve, SV - Safety Valve, RV - Relief Valve

Pumps:
CP - Centrifugal pump, PDP - Positive displacement pump, DDP - Deep draft pump, JP - Jet pump

(5) Quantity refers to the number of the same equipment used in the plant.

(6) Under mounting condition indicate the following as applicable:

CF for concrete floor mounting
CW for concrete wall mounting
DM for direct mounting
HM for hanger mounting
RM for rack mounting
CM for cabinet mounting
EM for equipment mounting

Mounting details such as number of bolts, weld length, etc. need not be indicated here.

(7) The columns "SEISMIC" and "OTHER DYNAMIC" need only be checked (X) if applicable. In the case of BWRs indicate "H" under "OTHER DYNAMIC" column where qualification includes hydrodynamic loads.

(8) Under "REQ'D INPUT (ZPA)," the applicable "g" level should be provided.

(9) Under Qualification Method under analysis, indicate "S" for static, and "D" for dynamic; under test frequency, indicate "SF" for single, and "MF" for multiple; and under text direction, indicate "SD" for single, "MD" for multiple.

(10) Equipment status is to be addressed separately to qualification and to installation.

The applicable letter should be provided under the column headed "QUAL," according to the following code:

A The qualification and associated documentation are complete.

B The qualification testing is finished but associated documentation is not yet submitted or still in review.

C The qualification plan/procedure is documented, but testing has not yet begun.

D Equipment to be qualified.

E Equipment is judged not qualifiable and will be replaced with qualified equipment.

F For BWR plants only: Equipment is qualified for seismic loading only. Requalification will be performed to account for the suppression pool hydrodynamic loading effects.

The applicable letter should be provided under the column headed "INSTALLATION," according to the following code:

A Installation is completed. Equipment is ready for service.

B Equipment mounting/hookup is completed, but significant parts of the equipment are not yet installed.

C Equipment is located at its intended service location, but mounting and/or hookup is not completed.

D The equipment is not installed and is not available for inspection.

(11) The Required Response Spectra (RRS) package should be provided along with the Master Listing. Only response spectra applicable to the listed equipment should be included, each numbered for reference under the column headed "RRS REF." In many cases, several equipment will reference the same RRS.

(12) Codes and Standards

Applicable codes, standards and Regulatory Guides should be indicated here, for example, ASME Section III Class 2; IEEE-344, 1975, 323-1974, 382-1972; ANSI N278-1, Regulatory Guide 1.100, 1.148 etc.

QUALIFICATION SUMMARY OF EQUIPMENT

° To be completed to stand on its own (do not refer to any document)
° All questions are to be answered (if not applicable; mark "N/A")

I. Plant Name: _____

1. Utility: _____
2. Location: _____
3. Type: _____ 4. Capacity (MWe Net): _____
5. Containment Type: _____ 6. Cooling Source:
7. NRC Docket No.: _____ 8. CP Docket Date: _____
9. NSSS Vendor: _____ 10. A/E: _____

II. Component Name: _____

1. Scope: [ ] NSSS [ ] BOP
2. Vendor: _____ 3. Vendor Model No.: _____
4. Manufacturer: _____ 5. Manufacturer Model No.: _____
6. Purchase Spec. No.: ____ 7. Total No. in Safety Systems: _____
8. Location (Choose the worst one with respect to seismic)
   a. Building: _____ b. Elevation and Area: _____
   c. Environment: [ ] Harsh [ ] Mild
9. Field Mounting:
   a. [ ] Floor [ ] Wall [ ] Pipe [ ] Panel
      [ ] Other (describe) _____
   b. [ ] Bolted; description: _____ (no. size, grade, etc.)
      [ ] Welded; description: _____ (size, length, electrode type, etc.)
      [ ] Other; description: _____
   c. Mounting restriction from the manufacturer, if any: (horizontal vertical, etc.)_____
10. Functional Description of the Equipment:
    a. System in which located: _____ (for item 8 in II, above)
    b. Type: [ ] Active [ ] Passive
    c. Equipment required for: [ ] Hot standby [ ] Cold shutdown
       [ ] Both [ ] Neither
    d. Intended safety function: _____
       _____

e. Direct consequences of its failure (brief description of the effect on the system): _____

_____

f. Redundancies, if any: _____

III. Equipment Qualification Method:

[ ] Test [ ] Analysis

[ ] Combination of test & analysis [ ] Other (describe) _____

IV. Loads and Load Combinations:

1. Loads:

a. [ ] Seismic b. [ ] Hydrodynamic

c. [ ] Flow induced vib. d. [ ] Normal operation vib.

e. [ ] Other dynamic loads: (specify) _____

2. Combination technique: _____

3. Required acceleration in each direction:

a. [ ] ZPA [ ] Other;specify: _____

b. OBE: s/s _____; f/b: _____; v: _____

SSE: s/s _____; f/b: _____; v: _____

V. Qualification by Test (complete this section for each report including partial test):

1. Test report: (Company) _____

a. Title: _____

_____

no.: _____; revision: _____; date: _____

b. Reviewed by: _____

2. Qualification report: (Company) _____

a. Title: _____

_____

no.: _____; revision; _____; date: _____

b. Reviewed by: _____

3. Laboratory mounting:

a. Describe [from shaker table to the equipment; include orientation, bolt (size, no., gr., etc.), weld (type, size, length, electrode type, etc.)]: _____

_____

b. If different from field mounting include equivalency justification:

_____

_____

4. Resonance search: [ ] yes [ ] no

a. Technique: _____

b. Excitation magnitude & frequency interval (or sweep rate): _____

_____

c. Resonances found: (up to: _____)

s/s: _____; f/b: _____; v: _____

5. Test Description:

a. Input:

(a) [ ] single axis; [ ] biaxial; [ ] pseudo biaxial;
[ ] tri-axial [ ] random; [ ] sine beat;
[ ] other: _____
[ ] phase coherent; [ ] phase incoherent

(b) Frequency range: _____

(c) Input level (g-level & frequency)

OBE: s/s: _____; f/b: _____; v: _____

SSE: s/s: _____; f/b: _____; v: _____

(d) Number of tests performed: OBE:___; SSE:___; other:_____

(e) Sequential test, including fatigue & vibration aging conducted: [ ] yes [ ] no

Justification, if not performed: _____

_____

b. Output:

(a) TRS generated: [ ] yes [ ] no

(b) Percent damping in TRS generation: _____

(c) Percent damping used in RRS: _____

(d) Margin included in RRS: _____

[ ] by test lab. [ ] by others: (specify) _____

(e) Attach sets of TRS and RRS comparison plots (if not provided, explain): _____

_____

c. Results:

(a) Basis of qualification:

[ ] structural integrity verified; [ ] operability verified

(b) Failures detected during qualification tests: _____

_____

_____

(c) Anomalies (with disposition) if any: _____

_____

_____

(d) Modifications made (in the equipment or mounting) during the qualification phase; describe, if any: _____

_____

_____

(e) How (modifications) implemented in the field: _____

_____

_____

d. Other tests performed (such as fragility test; include results)

_____

VI. Qualification by Analysis (complete this section for each report)

1. Analysis Report: (Company) _____

a. Title: _____

_____

no.: _____; revision: _____; date: _____

b. Reviewed by: _____

2. Qualification Report: (Company) _____

a. Title: _____

_____

no.: _____; revision: _____; date: _____

3. Failure modes: _____

_____

4. Method of Analysis:

[ ] static [ ] static coefficient [ ] dynamic

[ ] time history [ ] response spectrum

5. Natural frequencies (up to cut off frequency of: _____):

s/s: _____; f/b: _____; v: _____

6. Model type:

[ ] 1D; [ ] 2D; [ ] 3D

[ ] finite element: (kinds of elements used) _____

[ ] other: (specify) _____

7. Support & Boundary conditions in the model:

_____

_____

8. Computer codes used: _____

Method of verification: _____

9. Damping: OBE: _____; SSE: _____; Basis: _____

10. Fatigue & aging consideration: [ ] yes [ ] no

11. Responses:

a. Method of combination: [ ] ABS; [ ] SRSS;

[ ] algebraic, [ ] other, specify: _____

b. For critical elements:

Identification	Location	Loads	Total Calculated Stresses	Allowable Stresses	Source of Allowables

Identification	Location	Loads	Total Defl.	Allow. Defl.	Source of Allow. Defl.

VII. Surveillance and Maintenance Program:

1. Qualified life: _____
(based on weakest link or appendage in the equip.)

2. Basis: _____

3. Procedure of assuring operability of the equipment under seismic and dynamic condition throughout the plant life: _____

_____

PUMP AND VALVE
OPERABILITY ASSURANCE REVIEW

I. PLANT INFORMATION

1. Name: _____ Unit No. ___ 2. Docket No.: _____

3. Utility: _____

4. NSSS: _____ [] PWR [] BWR

5. A/E: _____

6. C.P. Docket Date: _____ C.P. SER Date: _____

II. GENERAL COMPONENT* INFORMATION

1. Supplier: [] NSSS [] BOP

2. Location: a. Building/Room _____

   b. Elevation _____

   c. System _____

3. Component I.D. No. on P&ID dwg: _____

4. If component is a [] Pump complete II.5.

   If component is a [] Valve complete II.6.

5. General Pump Data

a. Pump		b. Prime-mover	
Name	_____	Name	_____
Mfg.	_____	Mfg.	_____
Model	_____	Model	_____
S/N	_____	S/N	_____
Type	_____	Type	_____

---

* The component, whether pump or valve, is considered to be an assembly composed of the body, internals, prime-mover (or actuator) and functional accessories.

a. Pump (continued)

Overall Dimensions _____

Weight _____

Mounting Method _____

Required B.H.P. _____

b. Prime-mover (continued)

Overall Dimensions _____

Weight _____

Mounting Method _____

H.P. _____

Parameters:	Component Design	System Normal	System Accident
Press			
Temp			
Flow			
Head			
Media			
Required NPSH at maximum flow			
Available NPSH			
Operating Speed			
Critical Speed			

Prime-mover requirements: (include normal, maximum and minimum).

Motor (voltage) _____

_____

_____

Turbine (pressure) _____

_____

_____

If MOTOR list:

Duty cycle _____

Stall current _____

Class of insulation _____

List functional accessories:* _____

_____

_____

_____

_____

* Functional accessories are those additional sub-components that are required to make the pump assembly operational, (e.g., coupling, lubricating oil system, speed control system, feedback, etc.) Include manufacturer and model number.

6. General Valve Data

a. Valve	b. Actuator (if not an integral unit)
Name _____	Name _____
Mfg. _____	Mfg. _____
Model _____	Model _____
S/N _____	S/N _____
Type _____	Type _____
Size _____	Size _____
Weight _____	Weight _____
Mounting Method _____	Mounting Method _____
Required Operating Torque _____	Maximum Delivered Torque _____

Parameters:	Component Design	System Normal	System Accident
Press			
Temp			
Flow			
Media			

Power requirements: (include normal, maximum and minimum).

Electrical _____

_____

_____

Pneumatic/Hydraulic _____

_____

_____

Max ΔP across valve _____

Closing time @ max ΔP _____

Opening time @ max ΔP _____

List functional accessories:* _____

_____

_____

_____

III. FUNCTION

1. Describe components normal and safety functions (include accident initiating signals, if applicable):

Normal: _____

_____

_____

_____

Safety: _____

_____

_____

_____

2. The components normal state is: [] Operating [] Standby

3. Safety function:

a. [] Emergency reactor shutdown

b. [] Containment heat removal

c. [] Containment isolation

d. [] Reactor heat removal

e. [] Reactor core cooling

f. [] Prevent significant release of radioactive material to environment

g. [] Does the component function to mitigate the consequences of one or more of the following events? [] Yes [] No
If "Yes", identify.

[] LOCA [] HELB [] MSLB

[] Other _____

---

* Functional accessories are those additional sub-components that are required to make the valve assembly operational, (e.g., limit switches, solenoid valves, accumulators, etc.) Include manufacturer and model number.

4. Safety requirements:

[] Intermittent Operation [] During postulated event

[] Continuous Operation [] Following postulated event

If component operation is required following an event, give approximate length of time component must remain operational.

_____ (e.g., hours, days, etc.)

5. For VALVES:

Does the component [] Fail open [] Fail closed [] Fail as is

Is this the fail safe position? [] Yes [] No

Is the valve used for throttling purposes? [] Yes [] No

What is the maximum acceptable internal and external leakrate?

_____ _____

IV. QUALIFICATION

1. Reference by specific number the design codes and standards used as a guide to qualify the component:

_____

_____

_____

_____

2. Have acceptance criterias been established and documented in the test plan(s) for the component? [] Yes [] No

3. Are the margins* identified in the qualification documentation? [] Yes [] No

4. Was the component that was qualified a model or an actual assembly? _____. If a model, what was its scale? _____. If an actual assembly, was it qualified as an assembly or by sub-assemblies? (i.e., valve, actuator, pump, driver) _____

_____

* Margin is the difference between design basis parameters and the test parameters used for equipment qualification.

5. List all component tests performed or to be performed that demonstrate qualification:

6. List all component analyses performed that demonstrate qualification:

7. As a result of any of the tests (or analysis), were any deviations from design requirements identified? [] Yes [] No
If "Yes", briefly describe any changes made in tests (or analysis) or to the component to correct the deviation.

8. Was the tested component precisely identical (as to model, size, etc.) to the in-plant component? [] Yes [] No If "No", is installed component [] oversized or [] undersized?

9. Is component orientation sensitive? [] Yes [] No [] Unknown If "Yes", does installed orientation coincide with test/analysis orientation? [] Yes [] No

10. List all plant loading conditions considered during tests or analysis; (e.g., normal, upset, emergency, faulted).

_____

_____

11. What is the fundamental frequency of the component?

_____

_____

12. Does the component have a unique design or utilize unique material in its construction? (Examples are special gaskets or packing, one of a kind components, limitations on nonferrous materials, special coatings or surfaces, etc.)

[ ]Yes [ ]No If "Yes" identify: _____

_____

_____

13. What is the design (qualified) life of the component, exclusive of normal maintenance items such as packing, bearings, seals, diaphragm, gaskets, and other elastomers? _____

_____

14. Which of the components normal maintenance items requires the most frequent replacement/repair? _____
What is the normal time interval between replacements/repairs?

_____

15. List the harshest environmental conditions that the component could be exposed to during or following an accident, [e.g., temp., pressure, humidity, submergence, radiation (type and dose), etc.]:

_____

_____

_____

Information Concerning Qualification Documents for the Component

Report Number	Report Title	Date	Company/Organization Preparing Report	Company/Organization Reviewing Report

Operability Qualification of Purge and Vent Valves

Demonstration of operability of the containment purge and vent valves and the ability of these valves to close during a design basis accident is necessary to assure containment isolation. This demonstration of operability is required by NUREG-0737, "Clarification of TMI Action Plan Requirements," II.E.4.2 for containment purge and vent valves which are not sealed closed during operational conditions 1, 2, 3 and 4.

1. For each purge and vent valve covered in the scope of this review, the following documentation demonstrating compliance with the "Guidelines for Demonstration of Operability of Purge and Vent Valves" (attached, Attachment #5) is to be submitted for staff review:

   A. Dynamic Torque Coefficient Test Reports (Butterfly valves only) - including a description of the test setup.

   B. Operability Demonstration or In-situ Test Reports (when used)

   C. Stress Reports

   D. Seismic Reports for Valve Assembly (valve and operator) and associated parts.

   E. Sketch or description of each valve installation showing the following (Butterfly valves only):

      1. direction of flow

      2. disc closure direction

      3. curved side of disc, upstream or downstream (asymetric discs)

      4. orientation and distance of elbows, tees, bends, etc. within 20 pipe diameters of valve

      5. shaft orientation

      6. distance between valves

   F. Demonstration that the maximum combined torque developed by the valve is below the actuator rating.

2. The applicant should respond to the "Specific Valve Type Questions" (attached) which relate to his valve.

3. Analysis, if used, should be supported by tests which establish torque coefficients of the valve at various angles. As torque coefficients in butterfly valves are dependent on disc shape aspect ratio, angle of closure flow direction and approach flow, these things should be accurately represented during tests. Specifically, piping installations (upstream and downstream of the valve) during the test should be representative of actual field installations. For example, non-symetric approach flow from an elbow upstream of a valve can result in fluid dynamic torques of double the magnitude of those found for a valve with straight piping upstream and downstream.

4. In-situ tests, when performed on a representative valve, should be performed on a valve of each sinze/type which is determined to represent the worst case load. Worst case flow direction, for example, should be considered.

   For two valves in series where the second valve is a butterfly valve, the effect of non-symetric flow from the first valve should be considered if the valves are within 15 pipe diameters of each other.

5. If the applicant takes credit for closure time vs. the buildup of containment pressure, he must demonstrate that the method is conservative with respect to the actual valve closure rate. Actual valve closure rate is to be determined under both loaded and unloaded conditions and periodic inspection under tech. spec. requirements should be performed to assure closure rate does not increase with time or use.

GUIDELINES FOR DEMONSTRATION OF OPERABILITY OF PURGE AND VENT VALVES

OPERABILITY

In order to establish operability it must be shown that the valve actuator's torque capability has sufficient margin to overcome or resist the torques and/or forces (i.e., fluid dynamic, bearing, seating, friction) that resist closure when stroking from the initial open position to full seated (bubble tight) in the time limit specified. This should be predicted on the pressure(s) established in the containment following a design basis LOCA. Considerations which should be addressed in assuring valve design adequacy include:

1. Valve closure rate versus time - i.e., constant rate or other.
2. Flow direction through valve; ΔP across valve.
3. Single valve closure (inside containment or outside containment valve) or simultaneous closure. Establish worst case.
4. Containment back pressure effect on closing torque margins of air operated valve which vent pilot air inside containment.
5. Adequacy of accumulator (when used) sizing and initial charge for valve closure requirements.
6. For valve operators using torque limiting devices - are the settings of the devices compatible with the torques required to operate the valve during the design basis condition.
7. The effect of the piping system (turns, branches) upstream and downstream of all valve installations.
8. The effect of butterfly valve disc and shaft orientation to the fluid mixture egressing from the containment.

DEMONSTRATION

Demonstration of the various aspects of operability of purge and vent valves may be by analysis, bench testing, insitu testing or a combination of these means.

Purge and vent valve structural elements (valve/actuator assembly) must be evaluated to have sufficient stress margins to withstand loads imposed while valve closes during a design basis accident. Torsional shear, shear, bending, tension and compression loads/stresses should be considered. Seismic loading should be addressed.

Once valve closure and structural integrity are assured by analysis, testing or a suitable combination, a determination of the sealing integrity after closure and long term exposure to the containment environment should be evaluated. Emphasis should be directed at the effect of radiation and of the containment spray chemical solutions on seal material. Other aspects such as the effect on sealing from outside ambient temperatures and debris should be considered.

The following considerations apply when testing is chosen as a means for demonstrating valve operability:

Bench Testing

A. Bench testing can be used to demonstrate suitability of the in-service valve by reason of its traceability in design to a test valve. The following factors should be considered when qualifying valves through bench testing.

   1. Whether a valve was qualified by testing of an identical valve assembly or by extrapolation of data from a similarly designed valve.

   2. Whether measures were taken to assure that piping upstream and downstream and valve orientation are simulated.

   3. Whether the following load and environmental factors were considered

      a. Simulation of LOCA
      b. Seismic loading
      c. Temperature soak
      d. Radiation exposure
      e. Chemical exposure
      d. Debris

B. Bench testing of installed valves to demonstrate the suitability of the specific valve to perform its required function during the postulated design basis accident is acceptable.

   1. The factors listed in items A.2 and A.3 should be considered when taking this approach.

In-Situ Testing

In-situ testing of purge and vent valves may be performed to confirm the suitability of the valve under actual conditions. When performing such tests, the conditions (loading, environment) to which the valve(s) will be subjected during the test should simulate the design basis accident.

NOTE: Post test valve examination should be performed to establish structural integrity of the key valve/actuator components.