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

May 31, 1984

Docket Nos. 50-250
and 50-251

MEMORANDUM FOR: Gus C. Lainas

THRU: Steven A. Varga

FROM: Daniel G. McDonald

SUBJECT: BACKFIT ISSUE AT TURKEY POINT PLANT UNITS 3 AND 4

Backfit Issue: Regulatory Effectiveness Review (RER) and Vital Area Validation (VAV) Report.

Date raised with Licensee: Site review conducted May 23-27, 1983. The licensee was provided a draft at the exit meeting on May 27, 1983. The reports were sent to the licensee on March 6, 1984.

Licensees Position: The licensee has not formally indicated what actions they will take, however, they have expressed concern as to the RER/VAV Reports, lack of basis provided for requiring prompt corective action (in light of the findings of no potential sabatoge volnerabilities identified in the report) and the detailed NRC staff review and approval of the existing security plan for Turkey Point Plant Units 3 and 4.

Milestones:

5/27/83; RER/VAV site audit

8/12/83; Memo H. Clayton to C. Thomas comments and backfit concerns

8/23/83; Memo O. Parr to C. Thomas comments and backfit concerns

8/29/83; Memo D. McDonald to C. Thomas comments and backfit concerns

9/16/83; Memo G. Kennedy to H. Clayton comments and backfit concerns

11/8/83; Memo D. Eisenhut to R. Burnett comments on RER Report

1/31/84; Memo D. Zieman to C. Thomas comments and backfit concerns

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2/1/84; Memo O. Parr to C. Thomas comments and backfit concerns

2/6/84; Memo D. McDonald to C. Thomas comments and backfit concerns

4/2/84; Memo D. Eisenhut to R. Burnett comments RER Reports RER/VAV

3/6/84; Issued Reports to licnsee requesting their comments on the concerns and possible corrective actions in the reports. Requested timely response.

5/11/84; Licensee provided comments.

Applicability to other facilities: All operating reactors

Next schedule action: NRR (Special Projects) sending comments to NMSS.

Sent 6/1/84.

Daniel G. McDonald Jr

Daniel G. McDonald, Project Manager
Operating Reactors Branch #1
Division of Licensing

cc: J. Norris
G. McPeek
J. Thoma

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

November 4, 1983

Docket Nos. 50-237/249/254/265
LS05-83-11-017

Mr. Dennis L. Farrar
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Dear Mr. Farrar:

SUBJECT: CONTAINMENT ISOLATION DEPENDABILITY BY DEMONSTRATION OF CONTAINMENT PURGE AND VENT VALVE OPERABILITY

Re: Dresden Nuclear Power Station, Unit Nos. 2 and 3
Quad Cities Station, Unit Nos. 1 and 2

The staff with technical assistance from Brookhaven National Laboratory has completed its review of information submitted by Commonwealth Edison concerning operability of containment purge and vent valves for Dresden Units 2 and 3 and Quad Cities 1 and 2. Our review is documented in the enclosed Safety Evaluation. We find that the information submitted failed to demonstrate the ability of these valves to close against the buildup of containment pressure in the event of a DBA/LOCA. For this reason the purge and vent valves should be sealed closed in accordance with SRP Section 6.2.4.II.6.f. Furthermore, these valves should be verified closed at least once every 31 days.

Commonwealth Edison should either comply with the staff's requirement as stated in SRP Section 6.2.4.II.6.f or, within 30 days of receipt of this letter, provide the bases that would demonstrate the operability of the containment purge and vent valves in order to permit their continued use during operating modes 1, 2, 3 and 4.

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The reporting and/or recordkeeping requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

for Thomas V. Wambach
Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

Enclosure:
Safety Evaluation

cc w/enclosure:
See next page

Mr. Dennis L. Farrar

cc
Isham, Lincoln & Beale
Counselors at Law
One First National Plaza, 42nd Floor
Chicago, Illinois 60603

Mr. B. B. Stephenson
Plant Superintendent
Dresden Nuclear Power Station
Rural Route #1
Morris, Illinois 60450

U. S. Nuclear Regulatory Commission
Resident Inspectors Office
Dresden Station
Rural Route #1
Morris, Illinois 60450

Chairman
Board of Supervisors of
Grundy County
Grundy County Courthouse
Morris, Illinois 60450

U. S. Environmental Protection Agency
Federal Activities Branch
Region V Office
ATTN: Regional Radiation Representative
230 South Dearborn Street
Chicago, Illinois 60604

James G. Keppler, Regional Administrator
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

DRESDEN, UNITS 2 AND 3
DOCKET NUMBERS 50-237 AND 50-249

QUAD CITIES STATION, UNITS 1 AND 2
DOCKET NUMBERS 50-254 AND 50-265

DEMONSTRATION OF CONTAINMENT PURGE AND VENT VALVE OPERABILITY (B-24)

1.0 Requirement

Demonstration of operability of the containment purge and vent valves, particularly 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 BTP CSB 6-4 and SRP 3.10 for containment purge and vent valves which are not sealed closed during operational conditions 1, 2, 3, and 4.

2.0 Description of Purge and Vent Valves

The valves identified as the containment isolation valves in the purge and vent system are as follows:

Dresden Station Units 2 and 3

Unit No.	Valve Number	Size (Inches)	Use	Location
2	AO-2-1601-21	18	Not given	Outside containment
2	AO-2-1601-22	18	Not given	Outside containment
2	AO-2-1601-23	18	Not given	Outside containment
2	AO-2-1601-24	18	Not given	Outside containment
3	AO-3-1601-21	18	Not given	Outside containment
3	AO-3-1601-22	18	Not given	Outside containment
3	AO-3-1601-23	18	Not given	Outside containment
3	AO-3-1601-24	18	Not given	Outside containment

Quad Cities Station Units 1 and 2

Unit No.	Valve Number	Size (Inches)	Use	Location
1	AO-1-1601-21	18	Not given	Outside containment
1	AO-1-1601-22	18	Not given	Outside containment
1	AO-1-1601-23	18	Not given	Outside containment
1	AO-1-1601-24	18	Not given	Outside containment
2	AO-2-1601-21	18	Not given	Outside containment
2	AO-2-1601-22	18	Not given	Outside containment
2	AO-2-1601-23	18	Not given	Outside containment
2	AO-2-1601-24	18	Not given	Outside containment

The subject valves are butterfly type Model 2FII manufactured by H. Pratt Company. The Quad Cities valves are equipped with Tomkins-Johnson (part number AU-10-31) actuators and the Dresden valves with Miller (part number VPS-2502) actuators.

The valves are to be operated from their full open (0° = full open) position.

3.0 Demonstration of Operability

3.1 Commonwealth Edison (CE) has provided purge and vent valve operability demonstration information for Dresden, Units 2 and 3 and Quad Cities, Units 1 and 2 in the following submittals:

A. July 6, 1981 letter, T. J. Rausch (CE) to G. C. Lainas (NRC).

B. February 27, 1981 letter, R. F. Janecek (CE) to G. C. Lainas (NRC).

C. August 22, 1980 letter R. F. Janecek (CE) to G. C. Lainas (NRC).

3.2 Commonwealth Edison's (CE) dynamic torque (T_D) predictions for the subject 18-inch valves stem from dynamic torque coefficients (C_T) developed from a 6-inch (1/3 scale) model valve bench test program as documented in Appendix A of Reference C. The inlet piping configuration used in the test program was configured to establish uniform approach flow to the test valve. Flow tests were conducted with the valve disc set at fixed opening angle ranging from 8° to 78° (0° = full open) in 10° increments. Valve inlet pressures of 20 psia, 38 psia and 63 psia were established for each disc setting. Torque data measured off the 6-inch valve shaft was scaled to predict torques developed in the 18-inch inservice valve.

In that the bench test program did not include inlet piping configurations involving elbow type fittings, CE provided additional information to show that the torque values used for the 18-inch valve stress analysis were conservative regardless of the valve installation configuration.

CE reviewed each in service valve installation to determine if the piping involved an upstream elbow fitting (within 10 pipe diameters) and to determine the orientation of the valve shaft relative to the plane of the elbow. The results of CE's review is summarized in the table below.

Plant	Valve Number	Elbow Upstream Shaft in Plane	Elbow Upstream Shaft Out of Plane	No Elbow Effect
Dresden-2	-21	X		
	-22	X		
	-23		X	
	-24			X

Plant	Valve Number	Elbow Upstream Shaft in Plane	Elbow Upstream Shaft Out of Plane	No Elbow
Dresden-3	-21	X		
	-22	X		
	-23		X	
	-24			X
Quad Cities-1	-21	X		
	-22	X		
	-23			X
	-24		X	
Quad Cities-2	-21			X
	-22			X
	-23			X
	-24	X		

To account for the elbow-shaft out of plane installation configuration (worst case configuration relative to T_D prediction) CE effectively increased C_T (uniform flow) by a factor of 1.5 to establish the torque loads.

In their stress analysis, CE identifed the valve shaft as the critical valve part based on the stress at the disc to shaft pin location. The maximum stress at this location was calculated to be 11,256 psi resulting in a safety factor of 1.33 when using an allowable stress of 15,000 psi.

CE also compared the valve torque loads to the actuator torque output capability and concluded that the actuators are capable of closing the valve during the DBA/LOCA.

4.0 Evaluation

4.1 The T_D values predicted by CE for the 18-inch 2 FII valves in the Dresden and Quad Cities plants are very low in comparison to T_D values given by H. Pratt for the 18-inch 2 FII valves in the Prarie Island purge and vent system. Comparing the maximum T_D values predicted, CE predicts a maximum T_D of 2,600 in-lbs where H. Pratt's prediction is approximately 18,000 in-lbs.

In addition to the Prarie Island information, torque information available for other valve designs also indicate that CE's T_D predictions are low for an 18-inch valve.

Based on the above, the staff finds that the T_Ds predicted by CE for the subject valves are not conservative, and therefore not acceptable to the staff.

4.2 Although CE does not have test data to quantify the effect of piping elbow configurations on C_T (uniform flow) values for the 2 FII design, information available from other valve manufacturers indicated that for a given design at the same conditions the ratio of C_T (elbow-shaft in plane) to C_T (uniform flow) is greater than one and the ratio of C_T (elbow-shaft out of plane) to C_T (uniform flow) is greater than two in some instances. Based on limited elbow testing information available, the staff believes that where bench tests did not include elbows in the piping configuration a factor of 1.5 times C_T (uniform flow) for an elbow-shaft in-plane configuration and a factor of 3.0 times the C_T (uniform flow) for an elbow-shaft out of plane configuration would yield conservative values of T_D.

Based on the above, the staff finds that the 1.5 factor used by CE is conservative for those valves identified as having straight pipe inlet or elbow-shaft in-plane piping configurations and is not conservative for the three valves identified as having elbow-shaft out of plane configurations. To be acceptable to the staff, a factor of at least three times C_T (uniform flow) must be used for the three valves having elbow-shaft out of plane configurations.

4.3 CE indicated that the minimum elbow to valve separation distance required to assure uniform approach flow to the valve is 10 pipe diameters. CE should provide a source reference to justify using 10 D as the minimum. The staff would accept the separation distances referenced in the Instrument Society of America Standard S39.4.

4.4 Based on the discussions in Section 4.1, 4.2, and 4.3 of this report, the staff finds that CE has not demonstrated that the critical valve parts have sufficient design margins to withstand the pressure related loads of the DBA/LOCA.

4.5 Based on the discussions in Section 4.1, 4.2, and 4.3 of this report, the staff also finds that CE has not demonstrated that the actuators are capable of stroking the valve closed during the DBA/LOCA nor has CE demonstrated that the actuators are structurally capable of withstanding the resultant torque loads where those loads act to close the valve disc.

4.6 CE indicated that the seismic qualification of the subject valves is being handled by the Systematic Evaluation Program (SEP) and NRC Bulletin 79-14. CE should confirm that the subject valves have been seismically qualified.

4.7 Dresden-2 valves A02-1601-56, -60, -63, and -55, Dresden-3 valves A03-1601-56, -60, -63, and -55, Quad Cities-1 valves A01-1601-56, -60, -63, and -55, and Quad Cities-2 valves A02-1601-56, -60, -63, and -55 are not included in the review. The staff assumes that these valves are maintained closed during Modes 1, 2, 3, and 4.

5.0 SUMMARY

The staff has completed its review of the information submitted to date concerning operability of the 18-inch valves used in the containment purge and vent systems for Dresden, Units 2 and 3 and Quad Cities, Units 1 and 2. The staff finds that the information submitted did not demonstrate that these valves have the ability to close against the buildup of pressure in the event of DBA/LOCA from the full open position. Sections 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6 of the evaluation are the basis for these findings. For this reason, these valves should be sealed closed in accordance with SRP Section 6.2.4.III.6.f. Furthermore, these valves should be verified to be closed at least once every 31 days.

6.0 ACKNOWLEDGEMENT

R. J. Wright prepared this Safety Evaluation

Date: November 4, 1983

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

December 21, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commisison
Washington, D.C. 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Operability of Containment Purge and Vent Valves; Response to on NRC Safety Evaluation of Containment Vent and Purge Valves
NRC Docket Nos. 50-237/249 & 50-254/265

Reference (a): D. M. Crutchfield letter to D. L. Farrar dated November 4, 1983

Dear Mr. Denton:

The referenced letter stated that based on the staff's Safety Evaluation Report, the testing and information supplied to the NRC by Commonwealth Edison (CECo). failed to demonstrate operability of the containment purge and vent valves. As a result of the conclusion drawn, the staff directed CECo to seal the valves closed in accordance with SRP Section 6.2.4. III. 6.F and verify the valves to be closed at least once every 31 days or demonstrate the operability of the containment purge and vent valves in order to permit their continued use during operating modes 1, 2, 3 and 4.

The staff should understand that CECo cannot operate with the large containment vent and purge valves "sealed" closed during modes 1, 2, 3, and 4, e.g. at all times except during refuel outages. We must operate these valves in order to inert the containment, de-inert the containment, establish pressure differential between the drywell and suppression chamber, reduce containment oxygen content, and to reduce pressure in the containment. Attachment 1 provides a detailed list of the operating evolutions, the procedures used to perform the evolutions, and the containment vent and purge valves required for performance of the evolutions. These are Safety-Related evolutions that are required to be performed to meet technical specification requirements, mitigate the consequences of postulated accidents (LOCA), allow containment access during outages and when containment is not required, and to avoid a spurious scram and ECCS initiation. Because the containment vent and purge valves are administratively controlled by procedures outlined in Attachment 1, venting and purging are thus limited to the maximum extent possible while the reactor is in operation.

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However, as outlined above, the purge and vent valve must be opened for certain evolutions. Since valve openings are controlled by procedures, the valves cannot be inadvertently opened. Therefore, the valves need not be sealed closed. The stations are operating in a conservative manner and will continue to operate in this manner.

CECo has reviewed the NRC's Safety Evaluation Report provided in the reference. In general we find it to contain several inconsistencies. Therefore the basis for the safety evaluation is unclear. CECo would like clarification of paragraphs 4.1, 4.2 and 4.3 of the SER together with the reference material on which the evaluation is based. The sharing of this information will greatly help us in evaluating the accuracy of our operability studies. The requested clarifications are detailed in Attachment 2.

It is unclear to CECo why the staff would require the stations to seal closed all of the containment purge and vent valves when the staff concluded in the referenced SER, that CECo's operability studies may only be unconservative for three specific valves which contain out of plane elbows. Again details are provided in Attachment 2.

CECo is presently in the process of reevaluating the operability studies and information that was supplied to the staff. CECo plans to complete the reevaluation within 60 days, upon receipt of information requested from the staff.

The ensuing paragraphs provide responses to specific questions/ comments that were in the NRC SER directed to CECo.

In item 4.6 of the safety evaluation the staff asked CECo to confirm that seismic qualification of the purge and vent valves was handled by the Systematic Evaluation Program (SEP) and I.E. Bulletin 79-14. In our review of the SEP program, it appears that there were no specific studies performed that addressed the seismic qualification of the subject valves. The piping and valves are supported in accordance with original seismic design criteria. Modifications were performed as necessary to meet the requirements of I.E. Bulletin 79-14.

In Item 4.7 of the Safety Evaluation, it is mentioned that valves AO-1601-56, 60, 63 and 55 are assumed closed during modes 1, 2, 3 and 4. This is not true. The correct information is provided as follows:

Valve No.	Function	Remarks
AO-1601-55	Drywell and suppression chamber nitrogen purge inlet.	This is a 4" gate valve that remains open during normal operation to maintain pressure differential between the drywell and suppression chamber.

Valve No.	Function	Remarks
AO-1601-56	Suppression Chamber purge inlet.	This 18" butterfly valve remains open during normal operation to maintain pressure differential between the drywell and suppression chamber.
AO-1601-60	Suppression chamber vent outlet.	This 18" butterfly valve is used to inert and de-inert the suppression chamber.
AO-1601-63	Drywell and suppression chamber vent outlet to SBGTS.	This is a 6" butterfly valve used to vent the containment to inert, de-inert, relieve pressure, reduce oxygen content, and to establish pressure differential between the drywell and suppression chamber.

From the above table, AO-1601-55 and AO-1601-63 should not be considered in this issue since 1601-55 is a gate valve and 1601-63 is only a 6" diameter valve. This is the same reason that the 2" bypass valves around AO-1601-60 and AO-1601-23 (valves AO-1601-61 and AO-1601-62, respectively) are not considered.

In summary CECO is reassessing the operability studies that were performed. CECo is directing this review to the three valves that appear to be unconservative, 1601-23 (Dresden 2, 3) and 1601-24 (Quad Cities 1). These valves have elbow-shaft out of plane configurations. CECo plans to have the reviews completed within 60 days contingent upon receipt of information requested in this letter.

To the best of my knowledge and belief, the statements contained herein are true and correct. In some respects, these statments are not based on my personal knowledge but upon information furnished by other Commonwealth Edison and contractor employees. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

If you have any questions regarding this matter, please contact this office.

Very truly yours,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

cc: R. Gilbert (NRR)
R. Bevan (NRR)
NRC Resident Inspector - Dresden
NRC Resident Inspector - Quad Cities

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QUAD-CITIES STATION CONTAINMENT
VENTING and PURGING

Operating Evolution Title	QOP Procedure	Vent and Purge Valves Operated
a. Drywell Pressure Relief Through SBGTS	1600-1	AO-1601-63 and AO-1601-62
b. Suppression Chamber Pressure Relief Through SBGTS	1600-2	AO-1601-63 and AO-1601-61
c. Drywell Pressure Relief Through Vent. System	1600-3	AO-1601-24 and AO-1601-62
d. Suppression Chamber Pressure Relief Through Vent. System	1600-4	AO-1601-24 and AO-1601-61
e. Inerting Using Nitrogen Steam Vaporizer with SBGTS	1600-5	AO-1601-63, 23, 21 and 55 for drywell; AO-1601-63, 60, 56, and 55 for suppression chamber.
f. Inerting Using Steam Vaporizer with Vent. System	1600-6	AO-1601-24, 23, 21 and 55 for drywell; AO-1601-24, 60, 56, and 55 for suppression chamber.
g. De-inerting Using SBGTS	1600-7	AO-1601-60, 62, 63, 21, 23, 22, and 56
h. De-inerting Using Vent. System	1600-8	AO-1601-24, 62, 21, 22, 23, 56 and 60
i. Reduce Containment Oxygen Content During Power Operation	1600-10	AO-1601-61 and 63; use nitrogen makeup.
j. Post-Accident Containment Venting	1600-13	AO-1601-61, 63 for suppression chamber; AO-1601-62, 63 for drywell.

Operating Evolution Title	QOP Procedure	Vent and Purge Valves Operated
k. Drywell-Suppression Chamber Differential Pressure Using Nitrogen Makeup	1600-14	AO-1601-61 and 63 (SBGTS) or AO-1601-61 and 24 (Vent.), with nitrogen makeup. Also, use AO-1601-21 and 55 if need nitrogen purge.
l. Differential Pressure Compressor Startup/ Shutdown	1600-15 1600-16 1600-21 1600-22	AO-1601-55 and 56.
m. Inerting Using Electric Nitrogen Vaporizers	1600-19 1600-20	If use SBGTS; AO-1601-63, 23, 21, 55, 60, and 56. If use Vent. System; AO-1601-24, 23, 21, 55, 60, and 56.
n. Containment Venting and Purging During Extended Shutdown	1600-23	AO-1601-22, 56, 60, and 24 for the suppression chamber; AO-1601-22, 21, 23, and 24 for the drywell.

Attachment 2

Paragraph 4.1 - This paragraph qualitatively compares the T_D valves precicted by Commonwealth Edison based upon test data to valves predicted by Henry Pratt Valves, Inc. for Priairie Island, and to valves "available for other valve designs". This information needs to be reviewed by CECo to determine the applicability of such a comparison. In particular, definition of the operating conditions from which the other information is derived needs to be made.

Paragraph 4.2 - This paragraph appears to contradict paragraph 4.1 in part. The statement is made that the T_D valves provided by CECo is conservative except for those three valves (out of 16) which have elbow-shaft out of plane configurations. This suggests that these three valves are only ones unacceptable " as is" in the SER.

Paragraph 4.3 - This paragraph refers to Instrument Society of America (ISA) standard S39.4. ISA literature suggests that this standard was superceded in 1980 by standard ISA-S75.02 (1981). Our architect/engineer NUTECH has obtained a copy of this, and will review it against the 10 pipe diameter criterion assumed by NUTECH in earlier work.

Paragraph 4.4, 4.5 - Because of the ambiguity of paragraphs 4.1, 4.2, and 4.3, CECo believes that there is no basis for global statements as contained in these paragraphs. We believe that the only questionable valves in light of 4.1 and 4.2, are valves 1601-23 (Dresden 2, 3) and 1601-24 (Quad Cities 1).

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One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

May 3, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Containment Purge and Vent Valve
Operability
NRC Docket Nos. 50-237/249 & 50-254/265

References (a): B. Rybak letter to H. R. Denton dated December 21, 1983.

(b): D. M. Crutchfield letter to D. L. Farrar dated November 10, 1983.

(c): T. J. Rausch letter to G. C. Lainas dated July 6, 1981.

(d): NUTECH Report COM-0708-03, May, 1980.

Dear Mr. Denton:

This letter is written to provide the responses to the NRC concerns pertaining to the operability of the containment purge and vent valves identified in the Reference (b) letter and discussed during subsequent meetings. The specific response to each concern is given in Attachment 1.

The following provides a summary of the responses to the NRC concerns from the Reference (b) letter and subsequent conversations.

1. The hydrodynamic torque (T_D) valves used in the stress evaluation of the subject valves were developed from scale model tests. The scale model tests performed at FluiDyne and Allis-Chalmers provide an empirical basis for the hydrodynamic torque values used to demonstrate the operability of the 18 inch butterfly valves installed at Dresden and Quad Cities. All critical valve parts have sufficient design margins to withstand the pressure related loads of the DBA/LOCA.

2. The hydrodynamic torque (T_D) values used in the stress evaluation of the subject valves were also used to demonstrate the capability of the valve actuators. The valve actuators are capable of stroking the valves closed during the DBA/LOCA. The valve actuators are structurally capable of withstanding the actuator and hydrodynamic torque loads when the hydrodynamic torque acts to close the valve disc.

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3. The Systematic Evaluation Program (SEP) review of Dresden Unit 2 concluded on a generic basis that the equipment and systems required for safe shutdown will remain functional under the design hazard.

4. Since these valves will perform their safety function in the event of a DBA/LOCA, Commonwealth Edison will continue to operate the purge and vent system in accordance with the procedures outlined in Attachment 1 of Reference (a). The subject valves were not sealed closed in accordance with SRP Section 6.2.4.III.6.f. These valves have not been verified to be closed every 31 days, because they are not sealed closed.

In addition to the technical concerns expressed in Reference (b), the NRC verbally requested additional information during a February 15, 1984 meeting Bethesda. Commonwealth Edison's response to the NRC's verbal information request is provided in Attachment 2. Attachment 2 contains a complete listing of all valve connected to the containment atmosphere. Those valves marked with an asterisk are either valves that are not active or valves less than two (2) inches in size. The listing does not completely identify the manufacturer(s) of the valve and its appurtenances. When a complete list becomes available it will be sent to you.

Based on the information provided in Attachments 1 and 2, Commonwealth Edison concludes that all valves directly connected to the primary containment atmosphere will perform their safety function in the event of a DBA/LOCA.

If you have any questions regarding this matter, please contact this office.

One signed original and forty (40) copies of this letter and the attachments are enclosed for your review.

Very truly yours,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

lm

Attachments

cc: NRC Resident Inspector - Dresden
R. Gilbert - NRR

8554N

ATTACHMENT 1

Dresden/Quad Cities Station

Response to NRC Concerns on Purge and Vent Valves

8554N

This attachment restates the NRC concerns from the November 10, 1983 NRC letter to CECo. After each concern, Commonwealth Edison's response is presented.

NRC PARAGRAPH 4.1 CONCERNS

"The T_D values predicted by CE for the 18-inch 2 FII valves in the Dresden and Quad Cities plants are very low in comparison to T_D values given by H. Pratt for the 18-inch 2 FII valves in the Prairie Island purge and vent system. Comparing the maximum T_D values predicted, CE predicts a maximum T_D of 2,600 in-lbs where H. Pratt's prediction is approximately 18,000 in-lbs.

In addition to the Prairie Island information, torque information available for other valve designs also indicates that CE's T_D predictions are low for an 18-inch valve.

Based on the above, the staff finds that the T_D predicted by CE for the subject valves are not conservative, and therefore not acceptable to the staff."

PARAGRAPH 4.1 RESPONSE

The torque values presented by Commonwealth Edison were determined based upon a bench test of a 6" Pratt butterfly valve (Reference 2). The disk of this valve was custom-machined to simulate the disk of the 18" Pratt 2FII valve used in the vent and purge systems at Dresden and Quad Cities. The aspect ratio of the 6" test valve was 0.2428. For the actual 18" valve, the aspect ratio is 0.2455. Thus, the modelling of the 18" valve is accurate. The test conditions were selected to maximize flow velocity at the valve for each upstream test pressure. Test pressure and valve disk angle were varied parametrically to identify the combination which produced maximum torque.

The maximum torque in an 18 inch butterfly valve as determined by the tests performed at FluiDyne is 216 ft-lbs (Section 7 of COM-0708-03). The 216 ft-lbs (2592 in-lbs) obtained from the test results is an empirical value rather than a prediction based on an analytical method of computing hydrodynamic torque. For uniform flow geometry, 2592 in-lbs is the maximum torque for an 18 inch butterfly valve installed in the Dresden and Quad Cities purge and vent systems. As indicated in the Pratt report, the Pratt maximum torque values were established based on a conservative bounding analysis for Prairie Island. Thus, the Pratt results are not appropriate for use on Dresden and Quad Cities since Dresden and Quad Cities specific test values are available. Note, the effect of non-uniform flow geometry was addressed separately as discussed in the Paragraph 4.2 response.

NRC PARAGRAPH 4.2 CONCERN

"Although CE does not have test data to quantify the effect of piping elbow configurations on C_T (uniform flow) values for the 2 FII design, information available from other valve manufacturers indicated that for a given design at the same conditions the ratio of C_T (elbow-shaft in plane) to C_T (uniform flow) is greater than 1.0 and the ratio of C_T (elbow-shaft out of plane) to C_T (uniform flow) is greater than two in some instances. Based on limited elbow testing information available, the staff believes that where bench tests did not include elbows in the piping configuration a factor of 1.5 times C_T (uniform flow) for an elbow-shaft in-plane configuration and a factor of 3.0 times the C_T (uniform flow) for an elbow-shaft out of plane configuration would yield conservative values of T_D.

Based on the above, the Staff finds that the 1.5 factor used by CE is conservative for those valves identified as having straight pipe inlet or elbow-shaft in-plane piping configurations and is not conservative for the three valves identified as having elbow-shaft out of plane configurations. To be acceptable to the Staff, a factor of at least three times C_T (uniform flow) must be used for the three valves having elbow-shaft out of plane configurations."

PARAGRAPH 4.2 RESPONSE

In Reference 2, CECo provided the NRC with a reference to test data prepared by Allis Chalmers Company for Dairyland Power. The test data showed that for valves with shafts in-plane with upstream elbows, no correction factor is necessary. For valves with shafts out of plane with upstream elbows, a factor of 1.283 is shown to adequately account for the effect of non-uniform flow on torque. This is documented in References 2 and 5. The Allis Chalmers results are suitable for comparison with the Commonwealth Edison results documented in Reference 2 since the upstream disk shape and aspect ratio of the Allis-Chalmers and Pratt valves are comparable. The Allis-Chalmers data cited by Commonwealth Edison predict a non-uniform flow factor that is conservative for the Pratt valves.

The maximum torque on a Pratt eighteen (18) inch butterfly valve, as scaled from test data gathered at FluiDyne, is 216 ft-lbs. Multiplying 216 ft-lbs by 1.283 yields a maximum torque value of 277 ft-lbs for "out-of-plane" valves. Since this is less than the 300 ft-lbs used in the valve analysis (Reference 4), the hydrodynamic torque value used in the stress analysis is applicable to the worst case geometry of upstream piping.

NRC PARAGRAPH 4.3 CONCERN

"CE indicated that the minimum elbow to valve separation distance required to assure uniform approach flow to the valve is 10 pipe diameters. CE should provide a source reference to justify using 10 D as the minimum. The staff would accept the separation distances referenced in the Instrument Society of America Standard S39.4."

PARAGRAPH 4.3 RESPONSE

The hydrodynamic torque value used in the stress analysis is applicable to the worst case geometry of upstream piping, i.e. a non-uniform approach flow is assumed for the analysis. Thus, the effect of non-uniform flow for valves with elbows upstream between 10D and the ISA criteria has already been accounted for in the analysis.

NRC PARAGRAPH 4.4 CONCERN

"Based on the discussions in Section 4.1, 4.2, and 4.3 of this report, the staff finds that CE has not demonstrated that the critical valve parts have sufficient design margins to withstand the pressure-related loads of the DBA/LOCA."

PARAGRAPH 4.4 RESPONSE

The valve component with the highest stress is the pin in the valve shaft with a predicted stress of 11.3 ksi. The yield strength for the pin material is 30 ksi. Based on an allowable stress of 90% of yield strength (27 ks), the lowest safety factor is 2.4. This value is judged to provide sufficient design margin in the critical valve part to withstand the pressure-related loads of the DBA-LOCA.

NRC PARAGRAPH 4.5 CONCERN

"Based on the discussions in Section 4.1, 4.2, and 4.3 of this report, the staff also finds that CE has not demonstrated that the actuators are capable of stroking the valve closed during the DBA/LOCA nor has CE demonstrated that the actuators are structurally capable of withstanding the resultant torque loads where those loads act to close the valve disc."

PARAGRAPH 4.5 RESPONSE

Although Pratt has not specified a maximum allowable operator torque for these valves, it has been demonstrated that the valve and operator linkage will function at 300 ft-lbs torque. (Reference 4). From scaled test results, the maximum torque developed in the linkage during a LOCA is 277 ft-lbs. (Reference 4). Note that the LOCA maximum torque (277 ft-lbs.) is less than the value used in NUTECH's actuator capability calculations (300 ft-lbs.).

The Miller air cylinder is rated for a maximum pressure of 250 psi. The peak air cylinder pressure during a LOCA, assuming that the solenoid valve fails and there is no venting and no adiabatic heating is 157 psi. This pressure is well below the air cylinder pressure rating.

Finally, the actuator is designed such that the hydrodynamic torque does not combine with the actuator spring imposed loads. The maximum torque in the actuator linkage is 277 ft-lbs.

NRC PARAGRAPH 4.6 CONCERN

"CE indicated that the seismic qualification of the subject valves is being handled by the Systematic Evaluation Program (SEP) and NRC Bulletin 79-14. CE should confirm that the subject valves have been seismically qualified."

PARAGRAPH 4.6 RESPONSE

Commonwealth Edison has determined that the subject valves have not been seismically qualified via specific testing or analysis. The original procurement specification did not include seismic qualification criteria.

CECo has reviewed the SEP and NRC Bulletin 79-14 and concluded that the seismic qualification of the subject valves was not specifically addressed under those programs. However, the senior seismic review team has concluded on a generic basis in their SEP report (Reference 7) that based on design redundance and their experience with respect to functioning of equipment in earthquakes throughout the world and under military requirements, the systems required for safe shutdown will remain functional during a seismic event.

NRC PARAGRAPH 4.7 CONCERN

"Dresden-2 valves AO-2-1601-56,60,63, and -55, Dresden-3 valves AO-3-1601-56,60,63, and -55, Quad Cities-1 valves AO-1-1601-56,60,63, and -55, and Quad Cities-2 valves AO-2-1601-56,60,63, and -55 are not included in the review. The staff assumes that these valves are maintained closed during Modes 1, 2, 3, and 4".

PARAGRAPH 4.7 RESPONSE

Valves AO-*-1601-55 and AO-*-1601-56 at Dresden 2, Dresden 3, Quad Cities 1, and Quad Cities 2 are not maintained closed during Modes 1, 2, 3, and 4. The pumpback system which maintains drywell-to-torus differential pressure requires that these valves be maintained in the open position. Although these valves were not considered in the initial evaluation, these valves were considered in the evaluation summarized in Attachment 2.

* : 1 and 2 for Quad Cities
2 and 3 for Dresden

ATTACHMENT 2

Additional Information

8554N

REVIEW OF BALL, GATE, AND GLOBE VALVES

During the February 15, 1984 meeting in Bethesda, the NRC requested a list of all active valves directly connected to the primary containment atmosphere. The subject list is included with this attachment.

The list of active valves directly connected to the primary containment atmosphere with Group 2 isolation includes valves of butterfly, ball, gate, and globe constructional design. Butterfly valves subject to the hydrodynamic lift effects of flow are addressed in Attachment 1. The operability of ball, gate, and globe valves is addressed below.

Ball and gate valve discs slide closely past the valve seat when the valve is opened or shut. Globe valve discs move perpendicular to the valve seat. Butterfly valves combine these two basic disc motions and it is this combination of disc motions that results in a hydrodynamic lift effect. Ball, gate, and globe valves are not subject to the hydrodynamic lift effect associated with butterfly valves.

The design of the ball, gate, and globe valves and the actuators was based on standard design considerations for these types of valves. A detailed review of a typical valve has been performed and the results indicate that the valve will remain operable under the following conditions:

1.	Maximum differential pressure across the valve seat	225 psi
2.	Maximum static pressure	225 psig @ 300°F

Based on the above detailed review, the ball, gate, and globe valves directly connected to the primary containment atmosphere have sufficient design margin to withstand the effects of a DBA/LOCA.

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

	DRESDEN 2	DRESDEN 3	QUAD CITIES 1	QUAD CITIES 2	POSITION	FUNCTION
A.	PRESSURE SUPPRESSION SYSTEM					
	P&ID M-25(AL)	P&ID M-356(ZZ)	P&ID M-34-1(TT)	P&ID M-76-1(ZZ)		
A1.	PEN X-125	PEN X-125	PEN X-25	PEN X-25		
	AO-2-1601-23	AO-3-1601-23	AO-1-1601-23	AO-2-1601-23	NC/FC	Drywell Purge and Drywell Vent Discharge
	AO-2-1601-24	AO-3-1601-24	AO-1-1601-24	AO-2-1601-24	NC/FC	Drywell Purge and Drywell Vent Discharge
*	AO-2-1601-62	AO-3-1601-62	AO-1-1601-62	AO-2-1601-62	NC	Drywell Vent Discharge Bypass
	AO-2-1601-63	AO-3-1601-63	AO-1-1601-63	AO-2-1601-63	NC/FC	Standby Gas Treatment Inlet
A2.	PEN X-318	PEN X-318	PEN X-203A	PEN X-203A		
	AO-2-1601-60	AO-3-1601-60	AO-1-1601-60	AO-2-1601-50	NC/FC	Torus Purge and Torus Vent Discharge
*	AO-2-1601-61	AO-3-1601-61	AO-1-1601-61	AO-2-1601-61	NC/FC	Torus Purge and Torus Vent Discharge Bypass
A3.	PEN X-126	PEN X-126	PEN X-26	PEN X-26		
	AO-2-1601-21	AO-3-1601-21	AO-1-1601-21	AO-2-1601-21	NC/FC	Drywell Purge and Drywell Vent Inlet
	AO-2-1601-22	AO-3-1601-22	AO-1-1601-22	AO-2-1601-22	NC/FC	Drywell Vent Inlet
	AO-2-1601-55	AO-3-1601-55	AO-1-1601-55	AO-2-1601-55	O/FC	Purge and PumpBack
	AO-2-1601-56	AO-3-1601-56	AO-1-1601-56	AO-2-1601-66	O/FC	Torus Purge, Torus Vent Inlet, PumpBack
*	MO-2-1601-57	MO-3-1601-57	MO-1-1601-57	MO-2-1501-57	O	Purge Make-up
*	AO-2-1601-58	AO-3-1601-58	AO-1-1601-58	AO-2-1601-58	O	Torus Purge Make-up
*	AO-2-1601-59	AO-3-1601-59	AO-1-1601-59	AO-2-1601-59	O	Drywell Purge Make-up
*	(See X-204)	(See X-204)	AO-1-8803	AO-2-8803	O	Drywell Air Sample Bypass Pump Return
*	(See X-204)	(See X-204)	AO-1-8804	AO-2-8804	O	Drywell Air Sample Bypass Pump Return
A4.	PEN X-309A	PEN X-309A	PEN X-217	PEN X-217		
*	FCV-2-8501-1A	FCV-3-8501-1A	FCV-1-8801D	FCV-2-8801D	O	Torus Air Sample
*	FCV-2-8501-1B	FCV-3-8501-1B	FCV-1-8802D	FCV-2-8802D	O	Torus Air Sample

*Valves less than 3" Nominal Pipe size have been included for completeness.

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

	DRESDEN 2	DRESDEN 3	QUAD CITIES 1	QUAD CITIES 2	POSITION	FUNCTION
A5.	PEN X-304	PEN X-304	PEN X-205	PEN X-205		
	AO-2-1601-20A	AO-3-1601-20A	AO-1-1601-20A	AO-2-1601-20A	NC/FO	Reactor Building to Torus Vacuum Breaker
	AO-2-1601-20B	AO-3-1601-20B	AO-1-1601-20B	AO-2-1601-20B	NC/FO	Reactor Building to Torus Vacuum Breaker
	AO-2-1601-31A	AO-3-1601-31A	AO-1-1601-31A	AO-2-1601-31A	C	Reactor Building to Torus Vacuum Breaker
	AO-2-1601-31B	AO-3-1601-31B	AO-1-1601-31B	AO-2-1601-31B	C	Reactor Building to Torus Vacuum Breaker
A6.	PEN X-143	PEN X-143	PEN X-43	PEN X-43		
*	FCV-2-8541-5A	FCV-3-8541-5A	FCV-1-8801A	FCV-2-8801A	O	Drywell Air Sample
*	FCV-2-8541-5B	FCV-3-8541-5B	FCV-1-8802A	FCV-2-8802A	O	Drywell Air Sample
*	FCV-2-9505A	FCV-3-9205A	FCV-1-8801B	FCV-2-8801B	O	Drywell Air Sample
*	FCV-2-9205B	FCV-3-9205B	FCV-1-8802B	FCV-2-8802B	O	Drywell Air Sample
*	FCV-2-9206A	FCV-3-9206A	FCV-1-8801C	FCV-2-8801C	O	Drywell Air Sample
*	FCV-2-9206B	FCV-3-9206B	FCV-1-8802C	FCV-2-8802C	O	Drywell Air Sample
A.7	PEN X-204	PEN X-204				
*	FCV-2-8501-3A	FCV-3-8501-3A	(See X-26)	(See X-26)	O	Drywell Air Sample Bypass Pump Return
*	FCV-2-8501-3B	FCV-3-8501-3B	(See X-26)	(See X-26)	O	Drywell Air Sample Bypass Pump Return
A.8	PEN X-	PEN X-				
*	AO-2-9207A	AO-3-9207A	Not	Not	O	Portable Pump Connection
*	AO-2-9207B	AO-3-9207B	Applicable	Applicable	O	Portable Pump Connection
A.9	PEN X-	PEN X-				
*	AO-2-9208A	AO-3-9208A	Not	Not	O	Portable Pump Connection
*	AO-2-9208B	AO-3-9208B	Applicable	Applicable	O	Portable Pump Connection

B. ATMOSPHERIC CONTAINMENT ATMOSPHERE DILUTION

P&ID M-707-1	P&ID M-707-2	P&ID M-642	P&ID M-642

C. INSTRUMENT AIR

P&ID M-37-2(KK)	P&ID M-367-2(AA)	P&ID M-24-2(AD)	P&ID M-71-2(U)

*Valves less than 3" Nominal Pipe size have been included for completeness.

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

	DRESDEN 2	DRESDEN 3	QUAD CITIES 1	QUAD CITIES 2	POSITION	FUNCTION
C1.	PEN X-139D	PEN X-139D	PEN X-32C	PEN X-32C		
*	AO-2-4720	AO-3-4720	AO-1-4720	AO-2-4720	O	Instrument Air Inlet from Drywell
*	AO-2-4721	AO-3-4721	AO-1-4721	AO-2-4721	O	Instrument Air Inlet from Drywell
D.	RADWASTE					
	P&ID M-39(SS)	P&ID M-369(NN)	P&ID M-43(AF)	P&ID M-85(AA)		
D1.	PEN X-117	PEN X-117	PEN X-18	PEN X-18		
	AO-2-2001-105	AO-3-2001-105	AO-1-2001-3	AO-2-2001-3	O/FC	Drywell Flor Drain Sump Discharge
	AO-2-2001-106	AO-3-2001-106	AO-1-2001-4	AO-2-2001-4	O/FC	Drywell Floor Drain Sump Discharge
D2.	PEN X-118	PEN X-118	PEN X-19	PEN X-19		
	AO-2-2001-5	AO-3-2001-5	AO-1-2001-15	AO-2-2001-15	O/FC	Drywell Equipment Drain Sump Discharge
	AO-2-2001-6	AO-3-2001-6	AO-1-2001-16	AO-2-2001-16	O/FC	Drywell Equipment Drain Sump Discharge
E.	TRAVERSING IN-CORE PROBE					
	P&ID M-37-2(KK)	P&ID M-367-2(AA)	P&ID M-24-2(AD)	P&ID M-71-2(U)		
E1.	PEN X-35	PEN X-35	PEN X-35G	PEN X-35A		
*	(5) 700-733	(5) 700-733	(5) 700-733	(5) 700-733	O	TIP Ball Valve

*Valves less than 3" Nominal Pipe size have been included for completeness.

DRESDEN STATION - MANUFACTURER'S SUMMARY

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

VALVE NUMBER		VALVE SIZE				
DRESDEN 2	DRESDEN 3	AND BODY	MANUFACTURER	REFEPENCE DWG.	OPERATOR	MANUFACTURER
* 2-0700-733	3-0700-733	1/2" - Ball				
AO-2-1601-20A	AO-3-1601-20B	20" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
AO-2-1601-20B	AO-3-1601-20B	20" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
AO-2-1601-21	AO-3-1601-21	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
AO-2-1601-22	AO-3-1601-22	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
AO-2-1601-23	AO-3-1601-23	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
AO-2-1601-24	AO-3-1601-24	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
2-1601-31A	3-1601-31A	20" - Check				
2-1601-31B	3-1601-31B	20" - Check				
AO-2-1601-55	AO-3-1601-55	- Ball				
AO-2-1601-56	AO-3-1601-56	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
*MO-2-1601-57	MO-3-1601-57	1" - Globe	Crane	B-103009	Motor	Limitorque SMB-000-2
*AO-2-1601-58	AO-3-1601-58	1" - Globe	Crane	B-140337	Air	Crane
*AO-2-1601-59	AO-3-1601-59	1" - Globe	Crane	B-104337	Air	Crane
AO-2-1601-60	AO-3-1601-60	18" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt
*AO-2-1601-61	AO-3-1601-61	2" - Globe	Crane	C665 B-103122	Air	Crane
*AO-2-1601-62	AO-3-1601-62	2" - Globe	Crane	C665 B-103122	Air	Crane
AO-2-1601-63	AO-3-1601-63	6" - Butterfly	Pratt	P340 12-10-90780(1)	Air	Pratt

(1) See drawings P340 24-10-31014A, P340 25-10-31014B, P340 25-10-31014C for additional information.

*Valves less than 3" Nominal Pipe size have been included for completeness.

DRESDEN STATION - MANUFACTURER'S SUMMARY
ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

VALVE NUMBER		VALVE SIZE				
DRESDEN 2	DRESDEN 3	AND BODY	MANUFACTURER	REFERENCE DWG.	OPERATOR	MANUFACTURER
AO-2-2001-5	AO-3-2001-5	3" - Gate	Crane	C665 B-101328	Air	
AO-2-2001-6	AO-3-2001-6	3" - Gate	Crane	C665 B-101329	Air	
AO-2-2001-105	AO-3-2001-105	3" - Gate	Crane	C665 B-101341-D	Air	
AO-2-2001-106	AO-3-2001-106	3" - Gate	Crane	C665 B-101342-D	Air	
*AO-2-4720	AO-3-4720	1"				
*AO-2-4721	AO-3-4721	1"				
*FCV-2-8501-1A	FCV-3-8501-1A	1/2"				
*FCV-2-8501-1B	FCV-3-8501-1B	1/2"				
*FCV-2-8501-3A	FCV-3-8501-3A	1"				
*FCV-2-8501-3B	FCV-3-8501-3B	1"				
*FCV-2-8541-5A	FCV-3-8541-5A	1/2"				
*FCV-2-8541-5B	FCV-3-8541-5B	1/2"				
*FCV-2-9205A	FCV-3-9205A	1/2"				
*FCV-2-9205B	FCV-3-9205B	1/2"				

*Valves less than 3" Nominal Pipe size have been included for completeness.

DRESDEN STATION - MANUFACTURER'S SUMMARY

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

VALVE NUMBER		VALVE SIZE				
DRESDEN 2	DRESDEN 3	AND BODY	MANUFACTURER	REFERENCE DWG.	OPERATOR	MANUFACTURER
*FCV-2-9206A	FCV-3-9206A	1/2"				
*FCV-2-9206B	FCV-3-9206B	1/2"				
*FCV-2-9207A	FCV-3-9207A	1"				
*FCV-2-9207B	FCV-3-9207B	1"				
*FCV-2-9208A	FCV-3-9208A	1"				
*FCV-2-9208B	FCV-3-9208B	1"				

*Valves less than 3" Nominal Pipe size have been included for completeness.

QUAD CITIES STATION - MANUFACTURER'S SUMMARY

ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

VALVE NUMBER		VALVE SIZE				
QUAD CITIES 1	QUAD CITIES 2	AND BODY	MANUFACTURER	REFERENCE DWG.	OPERATOR	MANUFACTURER
* 1-0700-733	2-0700-733	1/2" - Ball				
AO-1-1601-20A	AO-2-1601-20A	20" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
AO-1-1601-20B	AO-2-1601-20B	20" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
AO-1-1601-21	AO-2-1601-21	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
AO-1-1601-22	AO-2-1601-22	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
AO-1-1601-23	AO-2-1601-23	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
AO-1-1601-24	AO-2-1601-24	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
1-1601-31A	2-1601-31A	20" - Check	Atwood & Morrill	A585 20741-H	Self Actuated	
1-1601-31B	2-1601-31B	20" - Check	Atwood & Morrill	A585 20741-H	Self Actuated	
AO-1-1601-55	AO-2-1601-55	4" - Gate	Crane	C665 B-105341	Air	Crane
AO-1-1601-56	AO-2-1601-56	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
*MO-1-1601-57	MO-2-1601-57	1" - Globe	Crane	C665 B-103886	Motor	Limitorque SMB-000
*AO-1-1601-58	AO-2-1601-58	1" - Globe	Crane	C665 B-104336	Air	Crane
*AO-1-1601-59	AO-2-1601-59	1" - Globe	Crane	C665 B-104336	Air	Crane
AO-1-1601-60	AO-2-1601-60	18" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt
*AO-1-1601-61	AO-2-1601-61	2" - Globe	Crane	C665 B-103888	Air	Crane
*AO-1-1601-62	AO-2-1601-62	2" - Globe	Crane	C665 B-103888	Air	Crane
AO-1-1601-63	AO-2-1601-63	6" - Butterfly	Pratt	P340 12-10-90780	Air	Pratt

*Valves less than 3" Nominal Pipe size have been included for completeness.

QUAD CITIES STATION - MANUFACTURER'S SUMMARY
ACTIVE VALVES DIRECTLY CONNECTED TO THE PRIMARY CONTAINMENT ATMOSPHERE

VALVE NUMBER		VALVE SIZE				
QUAD CITIES 1	QUAD CITIES 2	AND BODY	MANUFACTURER	REFERENCE DWG.	OPERATOR	MANUFACTURER
AO-1-2001-3	AO-2-2001-3	3" - Gate				
AO-1-2001-4	AO-2-2001-4	3" - Gate				
AO-1-2001-15	AO-2-2001-15	3" - Gate				
AO-1-2001-16	AO-2-2001-16	3" - Gate				
*AO-1-4720	AO-2-4720	1"				
*AO-1-4721	AO-2-4721	1"				
*FCV-1-8801A	FCV-2-8801A	3/4" - Globe	Copes-Vulcan	C635 S-104167	Air(Diaphragm)	Copes Vulcan Model No. D-100-60
*FCV-1-8801B	FCV-2-8801B	3/4" - Globe	Copes-Vulcan	C635 S-140167	Air(Diaphragm)	Copes Vulcan Model No. D-100-60
*FCV-1-8801C	FCV-2-8801C	1/2"				
*FCV-1-8801D	FCV-2-8801D	1/2"				
*FCV-1-8802A	FCV-2-8802A	3/4" - Globe	Copes-Vulcan	C635 S-140167	Air(Diaphragm)	Copes Vulcan Model No. D-100-60
*FCV-1-8801	FCV-2-8801C	1/2"				
*FCV-1-8802D	FCV-2-8802D	1/2"				
*AO-1-8803	AO-2-8803	2" - Globe	Crane	C665 B-106702	Air	Crane
*AO-1-8804	AO-2-8804	2" - Globe	Crane	C665 B-106703	Air	Crane

*Valves less than 3" Nominal Pipe size have been included for completeness.