ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8905160041 DOC.DATE: 89/05/03 NOTARIZED: NO DOCKET #
FACIL:50-244 Robert Emmet Ginna Nuclear Plant, Unit 1, Rochester G 05000244
AUTH.NAME AUTHOR AFFILIATION
SMITH,R.E. Rochester Gas & Electric Corp.
RECIP.NAME RECIPIENT AFFILIATION
RUSSELL,W.T. Region 1, Ofc of the Director

See Rpt

SUBJECT: Provides info re replacement PORV block valves as discussed in Apr 1989 telcons,per H Gregg request.

DISTRIBUTION CODE: A046D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 18+219
TITLE: OR Submittal: TMI Action Plan Rgmt NUREG-0737 & NUREG-0660

NOTES:License Exp date in accordance with 10CFR2,2.109(9/19/72). 05000244

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD1-3 LA	1	0	PD1-3 PD	2	2
	STAHLE,C	1	1			
INTERNAL:	AEOD/DSP/TPAB	1	1	NRR/DEST/ADS 7E	1	0
	NRR/DEST/MEB 9H	1	1	NRR/DREP/EPB 10	1	1
	NRR/DREP/RPB 10	1	1	NUDOCS-ABSTRACT	1	1
	OC/LFMB	1	0	OGC/HDS2	1	0
	REG FILE 01	1	1	RES/DSIR/EIB	1	1
	RES/DSR DEPY	1	1			
EXTERNAL:	LPDR	1	1	NRC PDR	1	1
	NSIC	1	1			

Cert NO P340956932

R I D S / A D D S

Limited Dist.

8905160065
is a duplicate of
8206100265

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 20079) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

TOTAL NUMBER OF COPIES REQUIRED: LTTR 21 ENCL ~~12~~ 13

m/A-2 ltr

$\frac{dy}{dx} + y = 0$

ROCHESTER GAS AND ELECTRIC CORPORATION • 89 EAST AVENUE, ROCHESTER, N.Y. 14649-0001

ROBERT E. SMITH
Vice President
Production and Engineering

TELEPHONE
AREA CODE 716 546-2700

May 3, 1989

Mr. William T. Russell
Regional Administrator
U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King Of Prussia, Pennsylvania 19406

Subject: Information On Replacement Of PORV Block Valves
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Russell:

This letter provides information requested by Mr. Harold Gregg concerning replacement PORV block valves as discussed in several RG&E/NRC teleconferences which have taken place during April 1989.

The attached Appendix A, "Valve Operability for NUREG-0737", presents information which compares the new motor-operated PORV block valves being installed at Ginna Station with a similar valve tested by EPRI in 1981. This comparison supports our position that, with respect to the EPRI test, operability of the replacement valves is assured and that RG&E is keeping the commitments made in our response to NUREG-0737, Item II.D.1.

The attached Appendix B, "Valve Operability for NRC IEB 85-03", presents additional information which describes how the RG&E motor-operated valve testing program will be applied to the replacement PORV block valves to provide greater assurance of operability. This program was initially prepared in response to NRC IE Bulletin 85-03, is patterned after the Callaway "lead plant", uses MOVATS methodology and equipment and has received preliminary acceptance by the NRC.

We have attached the materials listed in Appendix C to assist you in your evaluation. Please do not hesitate to call if you have any questions, or if you require any further information on this subject.

Very truly yours,

Robert E. Smith,
Vice President
Production and Engineering

Cert No P340956932
A046
1/1

Attachments

xc: U.S. Nuclear Regulatory Commission (original)
Document Control Desk
Washington, D.C. 20555

xc: Ginna Senior Resident Inspector

GINNA STATION PORV BLOCK VALVE REPLACEMENT PROGRAM

APPENDIX A
VALVE OPERABILITY FOR NUREG-0737

Background

NUREG-0737 Item II.D.1 required qualification of reactor coolant system safety and relief valves. The plant specific evaluation of the Ginna safety valves and PORVs was submitted by RG&E on March 4, 1983. The NRC requested additional information from RG&E on February 21, 1985. Question 9 in the NRC request concerned the operability of the PORV block valves. In a letter from Roger Kober to John Zwolinski, Chief of Operating Reactors Branch Number 5, dated May 24, 1985, RG&E provided the NRC with the requested additional information. NRC Question 9 read:

> The submittal does not address the NUREG-0737 II.D.1 requirement that the operability of the PORV block valves be demonstrated. A test program on block valves was performed, though, which is described in the EPRI/Marshall Electric Motor Operated Valve Interim Test Data Report. In this test program the Limitorque SMB-000-5 motor operator that is used at the R. E. Ginna plant was not tested. Since the SMB-000-5 operator is smaller than any tested, explain how these test results or other test data can be used to demonstrate operability of the motor operator.

RG&E answered by comparing the valves and operators that were tested to the Ginna block valves and operators. The main difference was that the Ginna operators provided an output thrust at the as-shipped torque switch setting that exceeded the thrust required to close the valve by approximately 26 percent. The answer concluded:

> Since the valves at R. E. Ginna are of similar design except for the motor operators (the motor operators are different due to the closing time requirements) to the ones tested by EPRI and the output thrust is greater than required, the valves at R. E. Ginna will exhibit performance equal to or better than the EPRI test valves. The fact that the seat bore is smaller on the Ginna block valves results in a smaller thrust required to close the valve as compared to the test valve at the same differential pressure.

The NRC issued a Safety Evaluation Report entitled, "TMI Action--NUREG-0737, Relief And Safety Valve Testing, R. E. Ginna Unit 1, Docket No. 50-244," on August 20, 1987. The SER accepted the RG&E position that the operability of the block valves was based on the available closing thrust:

In a number of supplementary tests performed on the Velan block valves the torque switch settings for the SB-00-15 and SMB-00-10 operators were deliberately lowered in order to investigate valve operability at reduced operator torque. It was found that the test valve opened and closed satisfactorily even when the torque switch of the SB-00-15 or SMB-00-10 operator was set at the lowest value of 1.0 which corresponded to a torque of 82 ft-lb. Since the maximum torque the SMB-000-5 operator can deliver exceeds the torque required to operate the PORV block valve, the SMB-000-5 operator is more than adequate to assure the operability of the R. E. Ginna PORV block valves.

In summarizing its findings under Section 4.3.4, "Operability Summary," the SER stated:

The test results discussed above indicate that with the factory recommended ring setting, the R. E. Ginna safety valves are expected to operate stably. The licensee has provided ring settings that will ensure stable operation of the safety valves. The PORVs and block valves are expected to operate satisfactorily under the expected operating and accident conditions. Therefore, the following requirements which were discussed were met:

Item 1, requiring tests to qualify the safety valves, PORVs and block valves.

Item 4, requiring the use of the highest test pressures predicted by conventional safety analysis procedures.

Item 2, requiring determination of expected operating conditions using accidents and operational transients listed in Regulatory Guide 1.70, Revision 2.

Item 5, which requires qualification of PORV circuitry.

The NRC issued IE Bulletin 81-02, "Failure of Gate Type Valves to Close Against Differential Pressure", on April 9, 1981. IEB 81-02 states:

"The block valve qualification testing was proposed in NUREG-0737 primarily as an additional means of reducing the number of challenges to the emergency core cooling system and the safety valves during plant operation."

"However, for the block valves that have been tested concurrently, [the PORV] selection process was not followed because an NRC block valve test program had not been formulated. Therefore, seven readily available valves were obtained and tested by EPRI, primarily to obtain some general baseline information on block valve closure capability."

"The NRC staff also reviewed and concurred with the test conditions. To date, there has been no similar specific determination by EPRI or the NRC staff as to the relevance of the Marshall block valve test conditions to the conditions in any specific PWR plant under which a block valve should be able to close to isolate a stuck-open PORV."

IEB 81-02 noted that among the several valves that failed to fully close during the EPRI PORV block valve testing was an Anchor Darling 3-inch 1540-pound double-disc valve. With respect to this valve, IEB 81-02 stated:

"This valve, the first of a series of specially designed valves, has been modified, retested, and demonstrated to close under test conditions. The remaining valves will be similarly modified during manufacture. As a result, they are not included in this bulletin."

Ginna PORV Block Valve Replacement (Engineering Work Request [EWR] 3755)

The current Ginna PORV block valve replacement project will replace the existing block valves, which are original plant equipment, with new American Society Of Mechanical Engineers (ASME) Section III, Class 1, seismically-qualified, environmentally-qualified, motor-operated gate valves (as stated in paragraph 1.1.2 of the RG&E Design Criteria for this modification). This same Design Criteria document (Revision 0, dated January 22, 1986) references NUREG-0737, Section II.D.1, EPRI report NP-2541-LD, "EPRI/Marshall Electric Motor-Operated Valve (Block Valve) Interim Test Data Report" and NRC IE Bulletins 81-02 and 85-03. These documents were reviewed when the project was initiated, and were consulted periodically during the conceptual design, detailed design, and procurement phases. Other sections of the Design Criteria (1.1.1,1.2.2, 1.3.2, 8.1, 8.2, and 13.2) emphasize the anticipated service of the new PORV block valves.

The RG&E Safety Analysis for this project (Revision 0, dated January 22, 1986) specifically considers decreases in reactor coolant inventory, including inadvertent opening of a PORV. The Design Criteria document discussed above is specifically referenced in the Safety Analysis. The Design Criteria and the Safety Analysis constitute the project design input (see Attachments C.1 and C.2).

PORV Block Valves

The present Ginna PORV block valves are Velan Model B10-3054B-13M, three-inch, 1500 lb class, wedge-disc type, bolted bonnet, motor-operated gate valves with Stellite hardfacing. They are original plant equipment, designed and built to ASA and MSS standards. The Velan valves are similar to the Velan valves tested by EPRI.

The new Ginna PORV block valves are Anchor/Darling three-inch, 1513 lb class, double-disc type, pressure seal bonnet, motor-operated gate valves (see Attachment C.4). They are newly manufactured valves (not surplus), that have been designed and built to ASME Section III, Class 1 requirements. The valve bodies were manufactured using an investment casting method which allows for better control of dimensional tolerances than other processes, such as sand casting. The new valves feature cast in-place disc guides that are integral with the valve body; provisions for bonnet overpressurization protection; die-formed, square graphite stem packing; live-loaded packing glands (to reduce stem friction); and, 17-4PH stem material. Low-cobalt Ni-Cr hardfacing material is used on the discs and seat rings. EPRI reports NP-3446, "Evaluation of Low-Cobalt Alloys for Hardfacing Applications in Nuclear Components", and NP-4993, "Laboratory Evaluations of Cobalt-Free, Nickel-Based Hard-Facing Alloys for Nuclear Applications", indicate that the Ni-Cr alloys have coefficients of friction which are comparable to Stellite alloys. In general, the new Anchor/Darling valves are of a design that has incorporated the latest in improvements, including those improvements associated with EPRI testing, such as the elimination of raised faces on the seats.

An older design Anchor/Darling Model 5J-1512, three-inch, 1500 lb class, double-disc type, pressure seal bonnet, motor-operated gate valve with Stellite hardfacing was tested during the EPRI/Marshall program (see Attachment C.3). The body of this test valve was manufactured using the sand casting method, and utilized disc retainers. As discussed in IEB 81-02, the Anchor/Darling valve tested by EPRI was demonstrated to close under test conditions.

PORV Block Valve Motor Operators

The present Ginna PORV block valve motor operators are Limitorque Model SMB-000-5, with manual override handwheels. These valve operators are rated for torques of five ft-lbf at the electric motor output shaft, and 90 ft-lbf at the stem nut (see Attachment C.7). The full nominal unit thrust rating of 8,000 lbf is available during the initial portion of the valve opening stroke, when torque switches are electrically bypassed. Thrust is limited to lower values for the valve closing stroke and the remainder of the opening stroke by the current torque switch settings.

The new Ginna PORV block valve motor operators are Limitorque Model SMB-00-10 with manual override handwheels. They have been specified to meet the requirements of IEEE standards 323, 382 and 344. After the valve/operator assemblies were received, motor housing T-drains were added and the limit switch gearbox lubricant was replaced with Mobilgrease 28. These valve operators are rated for torques of ten ft-lbf at the electric motor output shaft, and 250 ft-lbf at the stem nut (see Attachment C.7). The full nominal unit thrust rating of 14,000 lbf is available during the initial portion of the valve opening stroke, when the torque switches are electrically bypassed. Thrust is limited to lower values for the valve closing stroke and the remainder of the opening stroke by adjusting the torque switch settings. Torque switch settings are chosen consistent with the value of required thrust at system differential pressure, based on calculations, or on field data from Ginna and other plants. Torque switch settings also consider the potential for valve damage and degradation, and are not arbitrarily set to maximum values. MOVATS, Incorporated equipment and techniques are being utilized during field adjustment of the new PORV block valve motor operators to determine proper torque switch settings.

The PORV block valve motor operators on the Anchor/Darling valve tested during the EPRI/Marshall program were Rotork Models 16 NA1 and 30 NA1. The Rotork Model 16 NA1 motor operator is nominally rated for 150 ft-lbf at the stem nut, and has a nominal thrust rating of 15,000 lbf (see Attachment C.6). The Rotork Model 30 NA1 motor operator is nominally rated for 250 ft-lbf at the stem nut, and has a nominal thrust rating of 25,000 lbf (see Attachment C.6).

During the EPRI/Marshall testing (see Attachment C.3) of the Anchor/Darling valve with a Rotork 30 NA1 motor operator, the valve closed completely 56 times, including three complete closes against full flow conditions. The Rotork 16 NA1 motor operator did not completely close the valve during early portions of the EPRI/Marshall testing, although the motor operator was shown to have sufficient capacity to always reopen the valve, even following manual full closures. As described in the EPRI/Marshall report, further supplementary testing with the 16 NA1 motor operator showed that the valve could be completely closed against full flow at a variety of torque switch settings. When the valve and motor operator were properly aligned and set up, it was capable of complete closure under the test conditions.

New PORV Block Valve Operability Testing

The new PORV block valves were shop tested by the vendor prior to shipment to verify operability under the design differential pressure of 2485 psi. A static hydrotest pressure of 2485 psig was applied to the inlet side of the valve disc while the downstream side of the valve disc was left filled with water, but was depressurized. The motor-operated valve was then actuated in the opening direction at a test voltage of 460 VAC. The test was repeated at the specified minimum test voltage of 345 VAC. Stroke time, motor current, test voltage and torque switch settings were all recorded. Both new PORV block valves and their motor operators were tested in this manner. Both units operated successfully during these tests. The test data is provided on copies of the applicable page from the Anchor/Darling Gate Valve Test Data Report (Attachment C.9).

The new PORV block valves will be subjected to a similar hydro static differential pressure test after installation. As part of the reactor coolant system hydro test, both PORV block valves will be stroked open against a differential pressure of at least 2000 psig as described in sections 6.13.3 through 6.13.6 of Ginna Station Procedure PT-7 (see Attachment C.10).

Conclusions

Based on the above discussion, RG&E has concluded that the new Anchor/Darling PORV block valves being installed at Ginna are superior to both the present Velan valves and the Anchor/Darling valve that was successfully tested in the EPRI/Marshall program. Appropriate valve design requirements, consistent with the RG&E Design Criteria, were specified in RG&E procurement documents; the valves were built to current nuclear industry standards under an approved quality assurance program; and, design improvements identified during the EPRI/Marshall testing program and during subsequent field experience were incorporated by the valve vendor.

The Limitorque SMB-00-10 motor operators being installed on the new Ginna PORV block valves have greater capacity than the Rotork 16 NA1 motor operator tested in the EPRI/Marshall program. This conclusion is supported by comparing the nominal stem nut torque ratings of 250 ft-lbf for the Limitorque SMB-00-10 to the Rotork 16 NA1's nominal rating of 150 ft-lbf. The EPRI/Marshall tests indicated that, when properly set up, the Rotork 16 NA1 motor operator was adequate. The manufacturer's rating of the Limitorque SMB-00-10 motor operator stem nut torque is nearly as great as the manufacturer's rating of the Rotork 30 NA1 motor operator. The Rotork 30 NA1 motor operator successfully closed the Anchor/Darling valve against full flow conditions throughout the applicable portion of the EPRI/Marshall Program.

Rotork motor operators, of any size, are clearly not the preferred choice for this application. As stated by the NRC in IEB 81-02, the valves and operators tested by EPRI were chosen on the basis of what was "readily available". Ultimately, comparisons between Limitorque and Rotork operators are of limited usefulness because they use different design concepts and torque switch settings cannot be readily correlated. As stated in IEB 81-02 the primary purpose of the EPRI testing was to obtain "some general baseline information" on the valves closure capability.

Data supplied by EPRI with the May 31, 1982 report on the EPRI/Marshall test program indicates that a majority of PWRs use Limitorque SMB-00 or SMB-000 motor operators on their PORV block valves (see Attachment C.3). Limitorque operators are used throughout nuclear power plants. NUREG/CR-4234 (Section 6.4) estimates that Limitorque has supplied 95% of the units at such plants. In the eight years since the EPRI/Marshall tests, intense efforts throughout the nuclear industry have reinforced the conclusion that these motor operators are correctly sized for use on PORV block valves. More recently, a broad base of field test data has been accumulated by MOVATS, Incorporated regarding the actual thrust capabilities of these motor operators and the actual thrust requirements of these types of gate valves. NRC internal acceptance has been obtained for use of a MOVATS testing program at Ginna Station, patterned after the Callaway "lead plant", in demonstrating motor-operated valve operability in response to IEB 85-03.

Operability testing was successfully performed on the new PORV block valves by the vendor (see Attachment C.9). Additional operability testing is planned by RG&E as part of post-installation testing (see Attachment C.10). The MOVATS database includes seven nearly identical 3-inch, double-disc Anchor/Darling valves with Limitorque SMB-00-10 motor operators which were field tested at elevated pressure differentials (one at 1000 psid, six at 2600 psid or above). The higher differential pressure values conservatively simulate the applicable system conditions for the Ginna PORV block valves. All those tests were successful and will provide guidance in properly setting the torque switches on the new Ginna PORV block valves.

Based on this information, and the fact that the Design Criteria (Attachment C.1) and Safety Analysis (Attachment C.2) for the new PORV block valves and motor operators replacement program specifically reference NUREG-0737 Item II.D.1, we conclude that RG&E is keeping the commitments made in our responses to NUREG-0737 with regard to assuring operability of the PORV block valves at Ginna Station.

Appendix A References

A.1 NUREG-0737, "Clarification Of TMI Action Plan Requirements," Enclosure 3, Pages 3-72 through 3-74, November 1980

A.2 Letter, John E. Maier (Vice President, RG&E) to Dennis M. Crutchfield (Chief, Operating Reactors Branch Number 5), "PWR Safety and Relief Valve Test Program, R. E. Ginna Nuclear Power Plant, Docket Number 50-244," April 15, 1982

A.3 "EPRI/Marshal Electric Motor Operated Valve (Block Valve) Interim Test Data Report," and, "EPRI Safety And Relief Valve Test Program PORV Block Valve Information Package," May 31, 1982

A.4 Letter, John E. Maier to Dennis M. Crutchfield, "Post-TMI Requirements, NUREG-0737, Item II.D.1, R. E. Ginna Nuclear Power Plant, Docket Number 50-244," March 4, 1983

A.5 Letter, John E. Maier to Dennis M. Crutchfield, "Post-TMI Requirements, NUREG-0737, Item II.D.1, R. E. Ginna Nuclear Power Plant, Docket Number 50-244," April 22, 1983

A.6 Letter, John A. Zwolinski (Chief, Operating Reactors Branch Number 5) to Roger W. Kober (Vice President, Electric and Steam Production, RG&E), "NUREG-0737, Item II.D.1 - Performance Testing Of Relief And Safety Valves," February 21, 1985

A.7 Letter, Roger W. Kober to John A. Zwolinski, "NUREG-0737, Item II.D.1 - Performance Testing of Relief and Safety Valves, R. E. Ginna Nuclear Power Plant, Docket Number 50-244," May 24, 1985

A.8 Letter, Carl Stahle (Project Manager, Project Directorate I-3) to Roger W. Kober, "Safety Evaluation Report, TMI Action -- NUREG-0737 (II.D.1), Relief And Safety Valve Testing, R. E. Ginna Unit 1, Docket Number 50-244," August 20, 1987

A.9 USNRC IE Bulletin 81-02, "Failure of Gate Type Valves to Close Against Differential Pressure", April 9, 1981

A.10 USNRC IE Bulletin 85-03, "Motor Operated Valve Common Mode Failure During Plant Transients Due to Improper Switch Settings", November 15, 1985

A.11 Design Criteria, Ginna Station PORV Block Valves Replacement, EWR 3755, Revision 0, January 22, 1986

A.12 Safety Analysis, Ginna Station PORV Block Valves Replacement, EWR 3755, Revision 0, January 22, 1986

A.13 EPRI Report NP-4993, "Laboratory Evaluations of Cobalt-Free, Nickel-Based, Hard-Facing Alloys for Nuclear Applications", March 1987

A.14 EPRI Report NP-3446, "Evaluation of Low-Cobalt Alloys for Hardfacing Applications in Nuclear Components", August 1984

A.15 NUREG/CR-4234, "Aging and Service Wear of Electric Motor-Operated Valves Used in Engineered Safety-Feature Systems of Nuclear Power Plants", June 1985

A.16 NUREG/CR-4692, "Operating Experience Review of Failures of Power Operated Relief Valves and Block Valves in Nuclear Power Plants", October 1987

A.17 Letter, Carl H. Berlinger (NRC) to William F. Kane (NRC), "Completion of the Review of the Licensee's Program to Meet IEB 85-03 for Ginna", March 22, 1989

APPENDIX B
VALVE OPERABILITY FOR NRC IEB 85-03

Background

NRC IE Bulletin 85-03 was issued November 1985 to request licensees to develop and implement programs to ensure that switch settings on certain safety-related motor-operated valves (in the high pressure coolant injection and emergency feedwater systems) are selected, set and maintained correctly to accommodate the maximum differential pressure expected on the applicable valves during both normal and abnormal events within the design basis.

The Union Electric Company's Callaway Station acted as "lead plant" in proposing to implement a program to address this issue by utilizing methodology, equipment and techniques developed by MOVATS, Inc. The Callaway program is understood to have been accepted by the NRC (see References B.8, B.9 and Attachment C.5).

The MOVATS equipment uses a linear variable displacement transformer (LVDT) attached to the motor-operated valve Belleville spring pack to measure compression, which can be correlated with the amount of torque being delivered by the motor-operator. This displacement is converted to an electrical output by the LVDT which is displayed on an oscilloscope and is recorded in computer memory for future reference. A load cell is attached to the top of the rising valve stem during the opening stroke to obtain a direct stem thrust measurement which is used for calibration purposes. In this manner, MOVATS equipment can be used to measure motor-operated valve parameters during zero-pressure testing, static differential pressure testing, partial differential pressure testing or full flow testing as appropriate for the particular situation at each valve.

The MOVATS personnel also use conservative versions of conventional industry calculations, for reference purposes, in estimating required stem thrust.

Beginning with the MOVATS efforts at the Callaway "lead plant", instrumented motor-operated valve testing throughout the nuclear power industry has generated a "database" of stem thrust values. In the years since the initial MOVATS "database" was created in 1986, hundreds of additional motor-operated valves have been tested and the results have been continuously incorporated into the "database". The tests were performed at a variety of differential pressures and, consequently, MOVATS will interpolate or extrapolate the "database" values to the actual conditions of interest on a specific valve.

RG&E described its proposed motor-operated valve testing program in a December 4, 1987 letter to the NRC (Reference B.2 and Attachment C.13). The RG&E program is patterned after the Callaway program and uses the methodology and equipment of MOVATS, Inc. RG&E submitted the detail of its proposed program in a July 8, 1988 letter to the NRC (Reference B.3) required to comply with IEB 85-03. The RG&E program recently received internal NRC acceptance, as stated in a March 22, 1989 letter from Carl H. Berlinger to William F. Kane (Reference B.4).

Determination of Target Values for Stem Thrust

A. Analytical techniques were used to assist in determining the stem thrust values which would be required to operate the valves, as described below:

Stem thrust for a gate-type valve is the amount of push-pull force required to be applied along the axis of the valve stem to move the valve gate either up or down. The stem thrust values actually cited herein, consistent with the usage throughout the industry, are the maximum thrust values required to either fully-open or fully-close the valve. Although these maximum values are different for the opening and closing directions, they both occur when the valve gate is at, or very near, its 100%-closed position and is fully inserted into its seat.

The stem thrust can be estimated by a relatively simple calculation which combines the following elements:

1. Seat Face Load, which is the product of the differential fluid pressure across the gate, the orifice area (i.e., that portion of the gate exposed to the differential pressure) and a valve factor which accounts for friction at the gate exposed to the differential pressure) and a valve factor which accounts for friction at the gate-to-seat surface. A valve factor of 0.3 is generally accepted throughout the industry and is applicable to Ni-Cr (low-cobalt) hardfacing materials as well as Stellite alloys. The seat face load opposes both opening and closing.

2. Stem Load (or Piston Effect), which is the product of the stem cross-sectional area and the "line" pressure (i.e., the pressure of the incoming fluid). Since the stem load force is always pushing up on the stem, it will assist valve opening and will oppose valve closure.

3. Stuffing Box Load, which is an estimate of the frictional resistance to stem motion provided by packing material used to seal the stem where it penetrates to body or bonnet. The magnitude of the stuffing box load is roughly proportional to the stem diameter. Stuffing box loads oppose opening and closing motion.

Stem thrust values were calculated in this manner for the new PORV block valves being installed at Ginna. Calculations were performed by the valve vendor (Anchor/Darling) during the design/construction of the valves. Confirmatory calculations (see Attachment C.12) were subsequently performed by an independent consultant (Gilbert/Commonwealth). The results are summarized below.

	Anchor/Darling	Gilbert/Commonwealth	
	DP=2485 psi	DP=2485 psi	DP=2250 psi
Opening stem thrust (calculated)	4958 lbs.	5173 lbs.	4778 lbs.
Closing stem thrust (calculated)	7650 lbs.	7369 lbs.	6766 lbs.

B. The methodologies, equipment and techniques of MOVATS, Inc. as used within the RG&E motor-operated valve testing program, are being applied to the Ginna PORV block valve replacement program for the purpose of determining what stem thrust would be required to operate the valves, as described below:

Field data has been collected and evaluated by MOVATS, Inc. since the mid-1980's at numerous nuclear power plants. As patterned after the Callaway "lead plant", the RG&E program can obtain meaningful stem thrust information from the database if a Ginna valve is found to have 4 identical, or 20 similar, valves already in the database.

If a Ginna valve is adequately represented in the MOVATS database, the specific techniques outlined in MOVATS Engineering Report E.R.1.0, "Differential Pressure Thrust Calculation Methodology" (Reference B.5 and Attachment C.8) are used to estimate the stem thrust which would be required to operate the valve.

To be judged identical, the four (or more) valves must match with respect to the valve type, manufacturer, orifice diameter and stem diameter. The new Ginna PORV block valves are not strictly "identical" in all these areas. However, all differences are in the conservative direction as explained below:

1. Valve type: identical. Double-disc or parallel-disc gate (PDG).

2. Manufacturer: identical. Anchor/Darling.

3. Orifice diameter (seat ring inside diameter): not identical. MOVATS database valves have an orifice diameter of 2.75 inches. The new Ginna PORV block valves have an orifice diameter of 2.5 inches. This represents a smaller disc area over which the differential pressure can act. The resultant contribution to stem thrust is, therefore, less and it requires <u>less</u> stem thrust to open and close the Ginna valves. By considering the Ginna valves among the larger-orifice database valves, a conservative estimate of required stem thrust is obtained.

4. Stem diameter: not identical. MOVATS database valves have a 1.25-inch stem diameter. The Ginna PORV block valves have a stem diameter of 0.75 inches. Since the "piston effect" (as described in A.2, above) is proportional to the cross-sectional area of the stem, its contribution to the Ginna valve stem thrust is smaller than that of the database valves. Therefore <u>less</u> thrust is required to open and close the Ginna valves and it is conservative to treat them as identical to the database valves.

The specific MOVATS database valve parameters are presented in Attachment C.11. The MOVATS methodology for estimating required values of stem thrust has generated the following target thrust values for the new Ginna PORV block valves:

Opening stem thrust: 8229 lbs (at 2485 psid)
(MOVATS target value)

Closing stem thrust: 9534 lbs (at 2235 psid)
(MOVATS target value)

The differential pressures of 2485 and 2235 for opening and closing, respectively, were chosen consistent with system conditions during the events in which the PORV block valves are required to operate.

Setting of Torque Switches to Achieve Minimum Required Thrust

After the RG&E Motor-Operated Valve Program determines the values of stem thrust required for the opening and closing strokes, the Limitorque motor-operators are adjusted to ensure that the target thrusts are achieved. Torque switches and limit switches are adjusted in accordance with program procedures to settings which are appropriate to proper operation.

Final confirmatory stroke testing of the valves are performed while the MOVATS instrumentation is still in place. These tests verify that the as-left torque switch settings correspond to stem thrust values which meet or exceed the previously determined target thrust values. This information is recorded on RG&E Motor-Operated Valve Test Program thrust verification data sheets.

The "as-left" torque switch settings (TSS) for the new PORV block valves correspond to the minimum available stem thrusts listed below:

	Target	MOV-515 As-Left	MOV-516 As-Left
Opening stem thrust:	8229 lbs.	8480 lbs. (TSS = 2.5)	9060 lbs. (TSS = 2.5)
Closing stem thrust:	9534 lbs.	10,300 lbs. (TSS = 3.0)	9560 lbs. (TSS = 2.75)

The "as-left" stem thrust values are reviewed with respect to the allowable rating of the valve and motor-operated assembly. Any potentially excessive thrusts are resolved by RG&E Engineering in concert with Limitorque, the valve vendor and, where appropriate, specialty consultants. The "as-left" stem thrust values are within the allowable ratings of the new PORV block valve and motor-operator assembly of 14,000 lbs.

Conclusions

Although the current scope of NRC IEB 85-03 is limited to emergency core cooling and emergency feedwater systems, and does not extend to PORV block valves, we believe that the same methodologies and equipment can be used to demonstrate PORV block valve operability with a level of assurance equal or better than that gained through the EPRI/Marshall tests.

The methodologies and equipment of MOVATS Inc., when properly applied, are a valid means of satisfactorily demonstrating valve operability. These techniques represent the state-of-the-art and are widely accepted throughout the nuclear power industry. The RG&E motor-operated valve test program uses the methodologies and equipment of MOVATS, is patterned after the Callaway "lead plant" and has been accepted within the NRC for implementation of the requirement of IEB 85-03.

As described in Appendix A, hydrostatic differential pressure testing for valve operability was successfully performed by the vendor, and similar testing will be performed after installation.

By taking the pro-active measures of applying current IEB 85-03 techniques to the PORV block valves, as originally intended for this project, another level of operability assurance is provided beyond those from EPRI/Marshall tests. Those tests were an effective means of obtaining general baseline information of block valve closure capability and are still relevant. However, it is also prudent to recognize that significant improvements in valve operability testing methods have been made since then.

Based on this information and the fact that the Design Criteria and Safety Analysis for the new PORV block valve and motor operator replacement program specifically reference NRC IE Bulletins 85-03 and 81-02, we conclude that RG&E is keeping the commitments made in our responses to NUREG-0737 with regard to assuring operability of the PORV block valves at Ginna Station.

Appendix B References

B.1 USNRC IE Bulletin 85-03, "Motor-Operated Valve Common Mode Failure During Plant Transients Due to Improper Switchings", November 15, 1985

B.2 Letter, Roger W. Kober to Carl Stahle, "IE Bulletin 85-03, Safety-Related Motor-Operated Valve Program, R.E. Ginna Nuclear Power Plant, Docket No. 50-244, December 4, 1987

B.3 Letter, Robert E. Smith to Carl Stahle, "IE Bulletin 85-03, Report Summarizing Program Completion, R.E. Ginna Nuclear Power Plant, Docket No. 50-244", July 8, 1988

B.4 Letter, Carl H. Berlinger (NRC) to William F. Kane (NRC), "Completion of the Review of the Licensee's Program to Meet IEB 85-03 for Ginna", March 22, 1989

B.5 MOVATS, Incorporated Engineering Report E.R.1.0, "Differential Pressure Thrust Calculation Methodology", Rev. 0, June 20, 1988

B.6 NUREG/CR-4234, "Aging and Service Wear of Electric Motor-Operated Valves Used in Engineered Safety-Feature Systems of Nuclear Power Plants", June 1985

B.7 NUREG/CR-4692, "Operating Experience Review of Failures of Power Operated Relief Valves and Block Valves in Nuclear Power Plants", October 1987

B.8 Letter, Donald F. Schnell (Union Electric Co.) to USNRC Document Control Desk, "Docket No. 50-483, Callaway Plant, Safety-Related Motor-Operated Valve Program", June 10, 1987

B.9 Letter, Donald F. Schnell (Union Electric Co.) to USNRC Document Control Desk, "Docket No. 50-483, Callaway Plant, Safety-Related Motor-Operated Valve Program", August 18, 1987

APPENDIX C
LIST OF ATTACHMENTS

C.1 Design Criteria for EWR 3755, Revision 0, dated January 22, 1986

C.2 Safety Analysis for EWR 3755, Revision 0, dated January 22, 1986

C.3 A copy of the applicable portions of the EPRI report, "EPRI PWR Safety And Relief Valve Test Program PORV Block Valve Information Package", dated May 31, 1982

C.4 A copy of Anchor/Darling drawing W8822777, Sheets 1 and 2, showing details of the valves being installed at Ginna and a copy of Anchor/Darling catalog information showing typical internal details of the double-disc gate valve design

C.5 Letter, Donald F. Schnell (Union Electric Co.) to USNRC Document Control Desk, "Docket No. 50-483, Callaway Plant, Safety-Related, Motor-Operated Valve Program", June 10, 1987, and letter, Donald F. Schnell (Union Electric Co.) to USNRC Document Control Desk, "Docket No. 50-483, Callaway Plant, Safety-Related, Motor-Operated Valve Program", August 18, 1987

C.6 Rotork Catalog Section 2, "Electric Motor Performance Data For 'A' Range Actuators"

C.7 Limitorque Rating Sheet SMB/HMB Design, SEL-9, Sheet 1 of 2

C.8 MOVATS, Inc. Engineering Report E.R.1.0, "Differential Pressure Thrust Calculation Methodology", Rev. 0, June 20, 1988

C.9 Selected pages from Anchor/Darling Gate Valve Test Data Report for new PORV Block Valve Tag No. 515 and 516

C.10 Ginna Station Procedure PT-7, "Hydro Test of Reactor Coolant System", Rev. 36, May 26, 1988

C.11 MOVATS Database Summary Table.

C.12 Gilbert/Commonwealth, Inc. calculation, "PRV Block Valve Thrust Calculation,"

C.13 RG&E letter, Robert E. Smith to Carl Stahle (NRC), "IE Bulletin 85-03, Report Summarizing Program Completion", July 8, 1988 and RG&E letter, Roger W. Kober to Carl Stahle (NRC), "IE Bulletin 85-03, Safety-Related Motor-Operated Valve Program" December 4, 1987.

ROCHESTER GAS AND ELECTRIC CORPORATION

GINNA STATION PORV BLOCK VALVE REPLACEMENT PROGRAM

ATTACHMENT C.1

The Design Criteria for EWR 3755, Revision 0, dated January 22, 1986