NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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McGuire Nuclear Station - Unit 1	0 5 0 0 0 3 6 9	1 OF 0 9

TITLE (4)
Motor Operated Valves Found With Undersized Operators Due to Design and Personnel Errors

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 5	0 7	8 6	8 6	— 0 0 9	— 0 2	1 0	1 0	8 6	McGuire Unit 2	0 5 0 0 0 3 7 0
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OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 8 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	XX 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
J.B. Day, Licensing	AREA CODE 7 0 4 — 3 7 3 - 7 0 3 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	XXX NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On May 7, 1986, during a review conducted in accordance with NRC bulletin IE-85-03, it was determined by Duke Power personnel that the electric motor operators (EMO) for Unit 1 valve 1NI-10, and Unit 2 valves 2NI-9, and 2NI-10 (Reactor Coolant Cold Leg Injection from the Charging Pumps) were insufficiently sized to guarantee opening of the valves under worst case design conditions. The torque switch setting for Unit 2 valve NV-7 (Reactor Coolant Letdown Outside Containment Isolation) was also found to be set incorrectly. The setting for Unit 1 valve NV-7 was found to be incorrectly specified in the switch setting database. The database was corrected and the switch setting was corrected. On May 8, 1986, it was also discovered that valve 1NI-9 had an inadequate EMO installed. With Unit 1 in power operation status, a temporary modification was made to the motor operators of valves 1NI-9 and 1NI-10 to make sufficient operator torque available to open the valves as an interim solution for continued operation.

The Unit 2 motor operators for valves 2NI-9 and 2NI-10 were replaced with adequate motor operators, and the torque switch for valve 2NV-7 was set as required. Valve 1NV-7 was found to have its torque switch setting set as required. Unit 1 was in Mode 1, Power Operation, at 80% power and Unit 2 was in Mode 6, Refueling, at the time of the discovery. This incident has been attributed to a design deficiency and a personnel error. Duke Power has determined that valves NI-9 and NI-10 would open as required with the incorrect valve motor operators installed as evidenced by previous safety injection actuations. The health and safety of the public were not affected by this incident.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

On May 7, 1986, it was determined by Duke Power personnel that the electric motor operators (EMO) for Unit 1 valve 1NI-10 (EIIS:BQ), and Unit 2 valves 2NI-9 (EIIS:BQ), and 2NI-10 (EIIS:BQ) (Reactor Coolant Cold Leg Injection from the Charging Pumps) were insufficiently sized to guarantee opening of the valves under worst case design conditions. The torque switch settings for Unit 2 valve NV-7 (EIIS:JM) (Reactor Coolant Letdown Outside Containment Isolation) was also found to be set incorrectly. The setting for Unit 1 valve NV-7 was found to be incorrectly specified in the switch setting database. The database was corrected and the switch setting was corrected. The discoveries were made during a review of EMO torque switch settings in accordance with NRC bulletin IE-85-03. With Unit 1 in power operation status, a temporary modification was made to the motor operators to make sufficient operator torque available to open the valves as an interim solution for continued operation of the unit. On May 8, 1986, upon inspection of the valve motor operators installed, valve 1NI-9 was found to have a motor operator different than that specified by the design drawings.

The Unit 2 motor operators for valves 2NI-9 and 2NI-10 were replaced with adequate motor operators and the torque switch for valve 2NV-7 was set at the proper torque setting. The motor operators for valves 1NI-9 and 1NI-10 were temporarily modified so that the valves would open as required under the worst case design conditions.

Unit 1 was in Mode 1, Power Operation, at 80% power, and Unit 2 was in Mode 6, Refueling, at the time of the discovery.

BACKGROUND:

Valves NI-9 and NI-10 (on Units 1 and 2) were originally designed to provide output isolation of the Boron Injection Tank (BIT). The valves now act as redundant isolation valves that admit high pressure safety injection (EIIS:BQ) flow from the Centrifugal Charging Pumps (CCPs) to the Reactor Coolant system (EIIS:AB). The BIT was removed because it was determined unnecessary by Duke Power Company and the NRC. The normal position of the valves is closed and their safety function is to open within 10 seconds of actuation. The two valves - for each unit - are 4 inch Walworth gate valves with electric motor operators. The valves are designed to open against a maximum differential pressure of 2735 psi. The motor operators for the valves were ordered by the valve manufacturer and shipped with the valves. The motor operators which came with valves NI-9 and NI-10 (both units) were manufactured by Rotork Controls Incorporated. They were model number 16NA2-43 designed to operate at 43 rpm and rated to deliver a maximum of 190 ft-lbs torque output.

Valve NV-7 (on Units 1 and 2) provides outside containment isolation of the Reactor Coolant system normal letdown. The valve is required to close within 10 seconds of the actuation of a safety injection signal. The valve is a 3 inch globe valve manufactured by Walworth with an electric motor operator. The valve is designed to

close against a maximum differential pressure of 600 psi. The motor operator for this valve was manufactured by Rotork Controls Incorporated. It is a model 14NA2-43, designed to operate at 43 rpm and rated to deliver 100 ft-lbs of torque output.

DESCRIPTION OF EVENT:

On May 7, 1986, during a review based on NRC IE Bulletin 85-03, it was discovered that valves 1NI-10, 2NI-9, and 2NI-10 did not have sufficiently sized motor operators as prescribed by design considerations. Also, valves 1NV-7 and 2NV-7 were discovered to have the design torque switch setting less than required for worst case design conditions. The EMO Valve Torque/Limit Switch Setting database listed the motor operators for valves NI-9 and NI-10 (both units) to be Rotork model number 16NA1-57 or 16NA2-57 (both 57 rpm actuators rated at 150 ft-lbs output torque). However, the EMO Valve Torque/Limit Switch Setting database listing of motor operator model numbers is not a controlled document. (Only the torque/limit switch settings listing in the database is controlled.) The controlled document which specifies the required speed rating of the valve/motor operator is the manufacturer supplied outline drawing. The outline drawing lists the required valve/operator speed for each valve by item number. The item number is assigned by Duke Power Company to reflect the valve type. The outline drawing listed a valve/motor operator speed of 43 rpm and 57 rpm for valve item numbers 4J-34 and 4J-32, respectively. Valve item number 4J-36 also was listed as 57 rpm. The valve cross reference (VCR) document is required to determine the valve item number for all valves. In the VCR, valves 1NI-9, 1NI-10, 2NI-9, and 2NI-10 were specified as valve item numbers 4J-34, 4J-32, 4J-36, and 4J-36, respectively. The valve manufacturer specified the required torque of 190 ft-lbs to meet the worst case design conditions. The EMO Valve Torque/Limit Switch Setting database specified the motor operator for valves 1NV-7 and 2NV-7 to be set at 55% of full rated torque. To meet the design criteria, the torque switch setting should have been 85% of full rated torque.

On May 8, 1986, upon inspection of the valves in the field, valve 1NI-9 was found with an 86 rpm actuator instead of the 43 rpm listed on the valve outline drawing. Also, valve 1NV-7 was documented as having the torque setting set correctly at 85% instead of 55% as specified by the design document.

The valve manufacturer for Units 1 and 2 valves NI-9 and NI-10 (Walworth) specified a 190 ft-lb rated motor operator. (The valves were originally installed with 43 rpm (190 ft-lbs) motor operators). During the Unit 1 preoperational ESF testing, several valves did not meet the required stroke times. The solution to the problems with valve stroke timing was to change the motor operators. Valves 1NI-9 and 1NI-10 received 57 rpm motor operators (rated at 150 ft-lbs) which enabled the valves to meet the 10 second response time limit. During the investigation of this event, documentation supporting the actual change could not be found. The design documents were changed to reflect the new operators; however, the manufacturer's

drawing for valve 1NI-9 was not revised. No firm date for the change could be determined. A search of past work requests on these valves did not reveal documentation of the change. The motor operator size design was changed prior to the release of the "as built" drawing. No revisions of the drawings reflected the time that the change was made.

Valve NV-7 (both Units 1 and 2) was found to have the torque switch setting specified by Duke Power less than required by the valve manufacturer. During the development of the design documents the torque setting was incorrectly recorded on the EMO Valve Torque/Limit Switch database. The valves were installed during the construction of the plant and the torque switches were set up in accordance with the EMO Valve Torque/Limit Switch Setting database (55% of full torque rating).

With Unit 1 operating in Mode 1 at the time of the discovery, valves 1NV-7 and 1NI-10 were declared inoperable at 1720 on May 7, 1986. Unit 1 entered the action statement of Technical Specification (T.S.) 3.6.3 which required valve 1NV-7 to be operable within 4 hours. Unit 1 also entered a T.S. action statement on 1NI-10 per T.S. 3.5.2, which required the valve to be operable within 72 hours. After valve 1NI-9 was found to have the incorrect motor operator installed, the valve was also declared inoperable at 1143 on May 8, 1986. With both valves 1NI-9 and 1NI-10 inoperable, Unit 1 entered T.S. action statement of 3.0.3 which required the initiation of shutdown on Unit 1 within 1 hour.

Three persons went to valve 1NV-7 to change the torque switch setting from 55% to 85%. When they arrived at the valve they documented on the work request that they found the torque setting already set at 85%. However, during an independent review of numerous motor operator torque switch settings and other inspections, the torque switch setting for valve 1NV-7 was later recorded as being set at 55%. The actual date of the inspection of valve 1NV-7 is uncertain but believed to be during June 1986. During the review of the inspection data, it was discovered that the torque switch setting for valve 1NV-7 was nonconforming to the EMO database and issued a work request to change the torque switch setting to 85%. On August 9, 1986, the work request to correct the torque switch setting for valve 1NV-7 was performed. The documentation of the work stated the torque switch setting was found at 55 and was changed to 85%.

In order to return valves 1NI-9 and 1NI-10 to operable status, an analysis was performed and a decision was made to jumper out (bypass) the torque switch on the installed motor operators. This modification would prevent the operators from stopping at the rated torque and produce an overtorque condition (the valves would either open or the motor operator would burn up on the first cycle). The modification was performed and the appropriate shift personnel were notified that valves 1NI-9 and 1NI-10 could only be cycled electrically one time and manual operation would be required to operate the valve a second time. The stall torque rating of the valve motor operators allowed the modification to be installed because the stall torque rating is at least 1.4 times the maximum rated torque. Valve 1NI-10 was declared operable at 1156 on May 8, 1986.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

During the installation of the modification on valve 1NI-9, it was discovered that a 43 rpm motor operator was not installed. Instead, an 86 rpm motor operator was installed. The 57 rpm and the 86 rpm motor operators are rated at 150 ft-lbs and the modification implemented on valve 1NI-10 would still enable valve 1NI-9 to operate. Valve 1NI-9 was declared operable at 1404 on May 8, 1986 after such modification was implemented. A search of previous work performed on valve 1NI-9 revealed that the 86 rpm motor operator had been installed on March 24, 1983. The work on the valve at the time of this job required the removal of the valve's motor operator for the valve to be worked on. After the valve maintenance, the EMO was reinstalled and the valve stroked open but would not close. The EMO motor had burned up apparently due to excessive strain on the operator during valve opening. A new motor was installed and the EMO was successfully bench tested.

The EMO was reinstalled and the new motor burned up apparently due to the motor overload heater not being replaced after the earlier burn-up. A new overload heater was installed with an entire new EMO obtained from stock. However, the EMO obtained from stock was designed for 86 rpm instead of the 43 rpm required. The 86 rpm EMO was installed without discovering it was the wrong model. The valve was then successfully time response tested and was returned to service.

The motor operators for valves 2NI-9 and 2NI-10 were replaced between May 21 and May 23, 1986. The 57 rpm motor operators were replaced with 43 rpm operators. After installation of the motor operators, the valves were time response tested successfully. The valves were then placed back in service. However, on June 3, 1986, as part of ESF testing, the valves were later time response tested and failed. The reason the test failed was the difference in test methods used. The time response test first performed after the changeout measured the time from the close limit switch actuation to the open limit switch actuation (valve travel). The ESF testing measured the time from the actuation signal to the open limit switch actuation. The actual times obtained were 9.4 seconds for the first test verses 10.2 seconds for the ESF test (maximum allowed time is 10 seconds). As a result of the increased time, a statement of operability was developed, after an analysis was performed to justify a maximum time of 11 seconds.

The torque switch setting of the Unit 2 valve 2NV-7 was changed on June 8, 1986 from 55% to 85% of full rated torque.

The design drawings for valves 1NI-9 and 1NI-10 were corrected and their motor operators are being changed from 150 ft-lbs to 190 ft-lbs operators during the present 1986 Unit 1 refueling outage. The design documents for valve 1NV-7 have also been changed as appropriate.

On June 10, 1986, the Temporary Modifications to valves 1NI-9 and 1NI-10 were removed so that the valve could be operated as they would have with the incorrect motor operator installed. On June 12, 1986, as part of the NI Check Valve Movement Test, valves 1NI-9 and 1NI-10 were tested under actual full flow conditions (with the CCP running prior to valve actuation). This testing was conducted in a effort

to demonstrate the ability of the valves to open as needed with the incorrect motor operators installed, and the valves opened successfully within the 10 seconds allowed. Also, on September 14, 1981, December 24, 1981, January 11, 1982, and November 2, 1985, safety injections were experienced by Unit 1. (LER Numbers 369/81-151, 369/81-193, 369/82-07, and 369/85-34) As required during a safety injection, both valves, 1NI-9 and 1NI-10, opened within their time limit. The incorrect valve motor operators were installed at this time.

CONCLUSION:

Part of this event has been attributed to a design deficiency due to motor operators rated at 57 rpm and 150 ft-lbs maximum torque being specified for valves 1NI-10, 2NI-9, and 2NI-10, and a torque setting of 55% of maximum torque (instead of the 85% value) being specified for the motor operator for valve NV-7 (both units). The motor operators for valves NI-9 and NI-10 (both units) were originally specified to be 43 rpm and 190 ft-lbs. These specifications were given by the valve manufacturer. The valve manufacturer ordered the original motor operator from Rotork Controls, Inc. (the motor operator manufacturer). The valves were installed on both units at McGuire with the correct motor operators installed. However, the design was changed by Duke Power Company to meet valve time response testing requirements. The design change inadequately verified that all requirements were met, which is evident by the deficient torque rating of the replacement motor operators.

A different part of this event has been attributed to a personnel error because of the installation of the wrong model motor operator (86 rpm) on valve 1NI-9. The motor operator installed is physically the same size as the operator removed. Insufficient attention was given to ensure the replacement motor operator was the exact model required. All persons involved in the error could not be determined due to lack of proper documentation on the work request. A contributing cause to the personnel error was a deficient procedure for removal and installation of Rotork motor operators. The procedure used to replace the motor operator on 1NI-9 on March 23, 1983, did not contain steps to verify the replacement motor operator was the correct model number.

Prior to the discovery of a wrong motor operator installed on valve 1NI-9, numerous changes had been made to the maintenance procedure used. Steps were added to verify the replacement model was correct. A different procedure has been developed to cover installation, removal, and set-up of Rotork motor operators. This procedure contains a data sheet which requires the recording of "as-found" and "as-left" model information. These tables of recorded information are side by side for easy recognition of any differences.

The torque switch setting for the motor operator for valve NV-7 (both units) was specified by the EMO Valve Torque/Limit Switch Setting database to be set at 55% of rated torque. Correspondence from the valve manufacturer specified the torque

switch setting to be 85%. The discrepancy occurred during the document development process. The design database was generated with an incorrect value which was not discovered until the IE Bulletin 85-03 review.

Several factors may have contributed to the apparent error. The motor operator for valve 1NV-7 is mounted upside down, which requires the setting indicator to be read upside down. With the motor operator upside down, a 55% setting could easily be read as an 85% setting. (The 55% mark is one division from the "min" setting and the 85% mark is one division from the "max" setting.) The torque switch cover cannot be fully removed when the operator is installed due to an obstruction (the cover can be partially removed to allow minimal access to the torque switch setting devices). The motor operator and valve are also mounted approximately 10 feet off the floor which makes access to the motor operator cumbersome. The torque switch setting scale does not contain numerical values to indicate the setting but only markings with "min" and "max". The open and closed torque switch setting scales which are side by side, are "mirror-imaged", so both scales do not have "min" on the left and "max" on the right.

A review of past reports revealed one incident where a motor operator was replaced with an incorrect replacement model (LER 369/83-21). This incident was discovered on April 19, 1983. As a result of this incident, a change was made to the Rotork maintenance procedure to ensure that correct actuator replacements would be made. No reports involving insufficiently sized motor operators were found. This event is considered an isolated incident.

There were no personnel injuries, radiation overexposures, or release of radioactive materials as a result of this incident.

CORRECTIVE ACTIONS:

Before Discovery:

1) The Rotork Maintenance procedure was changed to include steps for verification of correct motor operator model. (This corrective action was performed after the error was made but prior to the discovery.)

2) A new procedure has been developed for Rotork motor operator replacement with improved verification of correct motor operator model. (This corrective action was performed after the error was made but prior to the discovery.)

Subsequent:

1) A temporary modification was installed to the control circuit of the motor operators for valves 1NI-9 and 1NI-10 to allow full motor stall torque availability during opening. The modifications were removed from both valves on June 10, 1986.

2) The motor operators for valves 2NI-9 and 2NI-10 were changed from 150 ft-lbs to 190 ft-lbs operators (from 16NA1-57 to 16NA1-43).

3) The EMO Valve Torque/Limit Switch Setting database was changed to reflect manufacturer's specifications for valves NI-9, NI-10, and NV-7 (both units). The Valve Cross Reference was changed for valves 1NI-10, 2NI-9, and 2NI-10 to type 4J-34.

4) The inspection of all IEB 85-03 EMO valves in the fiels was completed.

Planned:

1) Duke Power Company will complete the review and testing of key EMO valves as outlined in NRC IE Bulletin 85-03.

2) The motor operators for valves 1NI-9 and 1NI-10 will be changed from 150 ft-lbs operators to 190 ft-lbs operators during the present 1986 Unit 1 refueling outage.

SAFETY ANALYSIS:

The ability of safety injection valves NI-9 and NI-10 (both units) to properly operate during an accident impacts only those accidents which initiate a safety injection (SI) signal. The inability of valves NI-9 and NI-10 to open upon receipt of an SI signal will result in the safety injection system operating in a limited condition during accidents which result in NC system depressurization. The inoperability of valves NI-9 and NI-10 during a large break Loss of Coolant Accident (LOCA) would have a negligible effect on the ability of the system to provide emergency core cooling since the Residual Heat Removal pumps provide almost the entire safety injection flow following this accident. For both small break LOCA and Steam Line Break (SLB) accidents, the Chemical and Volume Control system (EIIS:CB) pumps provide the high pressure (greater than 1900 psi) safety injection necessary for maintaining adequate coolant inventory and delivering borated water from the Refueling Water Storage Tank for reactivity control. With valves NI-9 and NI-10 closed, no high head safety injection flow from the NV pumps would be available and no safety injection would occur until the NC system pressure decreases below the shutoff head of the NI pumps (°1500 psig). Although the NC system pressure response for the small break LOCA and SLB transients analyzed in

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Chapter 15 of the McGuire Final Safety Analysis Report indicates the system pressure will decrease below 1500 psig quickly, the available safety injection flow during the initial time period of the accident will be reduced. Duke Power has determined that as evidenced by Licensee Event Reports 369/81-151, 369/81-193, 369/82-7 and 369/85-54, valves 1NI-9 and 1NI-10 would open as required with the incorrect valve motor operators installed if a Safety Injection was initiated.

LER 369/81-151 reports an August 14, 1981, safety injection on Unit 1 during power operation due to excessive feedwater being pumped into the steam generators. LER 369/81-191 reports a December 24, 1981, safety injection on Unit 1 when in cold shutdown due to a procedural deficiency. During calibration of the pressurizer pressure controller, a low steam line pressure safety injection actuation was inadvertently initiated on both trains. When the second channel was placed into the test position and SI blocks were cleared, a valid indication of low steam line pressure initiated the safety injection with the reactor coolant system at atmospheric pressure. LER 369/82-7 reports a January 11, 1982, safety injection on Unit 1 simultaneously with a reactor trip from power operation due to an inadvertent actuation of engineered safety features. LER 369/85-34 reports a November 2, 1985, safety injection on Unit 1 on low pressurizer pressure following a reactor trip from power operation.

Since the actuators on valves 2NI-9 and 2NI-10 were identical in size to the actuators on 1NI-9 and 1NI-10, valves 2NI-9 and 2NI-10 would also open as required.

Valve 1NV-7 is a Train B outside containment isolation valve for the Chemical and Volume Control system letdown flow path. The Train A inside containment isolation valves (three valves in parallel) provide redundant containment isolation capability of the flow path. If worst case design differential pressure were present when these valves were needed and an inside containment valve failed, valve 1NV-7 may have torqued-out during mid-stroke. A small flow (probably less than 20 gpm) would have resulted and containment isolation may not have been achieved. While the improper torque setting violates Technical Specifications, it does not present serious safety concerns since downstream piping is ASME Code Section III. The line would discharge to either the Volume Control Tank or the Recycle Holdup Tank. These tanks have sufficient capacity to receive a small flow for a substantial time period to allow operator action to manually close downstream valves. In the event that valve 1NV-7 had torqued-out before completely closing there are a number of manually operated valves downstream of valve 1NV-7 that could be closed to reduce the differential pressure across valve 1NV-7. When the differential pressure was reduced enough, valve 1NV-7 could have been stroked electrically and containment isolation achieved. Valve 1NV-7 could also be closed manually using its handwheel.

The health and safety of the public were not affected by this incident.

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October 10, 1986

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Washington, D.C. 20555

Subject: McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
LER 369/86-09-02

Gentlemen:

Pursuant to 10CFR50.73, please find attached revision 2 to Licensee Event Report 369/86-09. The report concerns Motor Operated Valves Found With Undersized Operators Due to Design and Personnel Errors and was originally submitted July 15, 1986. The enclosed revision contains newly discovered information concerning the setting of valve 1NV-7. Bars in the right margin indicate where changes have been made.

Very truly yours,

H.B. Tucker /JBD

Hal B. Tucker

JBD/107/jgm

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