UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

August 30, 2006

EA-06-136

Joseph E. Venable
Vice President Operations
Waterford 3
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 - NRC INSPECTION REPORT 05000382/2006009 AND NOTICE OF VIOLATION

Dear Mr. Venable:

On August 9, 2006, the NRC completed an inspection at your Waterford Steam Electric Station, Unit 3. The enclosed report documents the inspection findings which were preliminarily discussed on May 11, 2006, with Mr. Kevin Walsh and other members of your staff. A followup call concerning the disposition of the related enforcement activities was conducted with you and other members of your staff on June 23, 2006, and a final telephonic exit meeting was conducted on August 9, 2006.

This inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

The report documents one violation of 10 CFR 50.9, with two examples, for reporting inaccurate information to the NRC associated with the NRC's Safety System Unavailability (High Pressure Injection and Residual Heat Removal) Performance Indicators. The performance indicator information was inaccurate because your staff improperly concluded that the Train B high pressure safety injection and Train B containment spray systems were still available for the full range of potential accidents during an extended period when the containment safety injection sump suction valve was partially open during the period of November 11, 2003 to September 9, 2004. If this data had been accurately reported, then the High Pressure Injection Performance Indicator should have been Red and the Residual Heat Removal Performance Indicator should have been Yellow up until the point that the safety system unavailability performance indicators were replaced by the mitigating systems performance index (MSPI) on April 1, 2006.

The Enforcement Policy, Supplement VII, specifies that issues such as reporting inaccurate performance indicator data that would have caused a performance indicator to change color from Green to Yellow or Red would be a Severity Level III violation. However, the NRC has determined that a Severity Level IV violation was more appropriate in this particular circumstance. This determination was made primarily on the basis that the risk significance associated with the valve being mis-positioned was determined to be very low (Green) as documented in NRC Inspection Report 05000382/2004005. Additionally, under the NRC's recently implemented MSPI program, which replaced the safety system unavailability performance indicator program on April 1, 2006, a similar set of circumstances would have resulted in a Green outcome because of the differences in the way fault exposure is treated under the former safety system unavailability performance indicator program and the current MSPI program. While the overall risk significance of the underlying performance deficiency was low, the failure to provide accurate information calls into question the ability to effectively and consistently implement the performance indicator program, particularly for circumstances in which the performance indicator outcome may result in a degradation of the cornerstone safety objective.

The Severity Level IV violation is being cited because not all the criteria specified in Section VI.A.1 of the NRC Enforcement Policy for a noncited violation were satisfied. Specifically, Entergy failed to restore compliance and report corrected or accurate performance indicator information, or otherwise notify NRC that the data reported in the past was not accurate, within a reasonable time after the potential violation was initially identified. For the purposes of this criterion, you were notified of the violation during the May 11, 2006, exit debrief meeting. Even though the safety system unavailability performance indicators were superceded by MSPI before the date of the exit meeting, the failure to accurately report the data was still material because the NRC used the information to determine its level of oversight of Waterford 3. Additionally, as stated in the Enforcement Policy, 10 CFR 50.9 violations are not evaluated under the Significance Determination Process because violations of this nature impact the ability of the NRC to properly regulate its licensees. You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will review your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

The NRC Action Matrix is described in NRC Inspection Manual Chapter 0305, "Operating Reactor Assessment Program." In accordance with the Action Matrix, one Red and one Yellow performance indicator input would have placed your facility in the "Multiple/Repetitive Degraded Cornerstone," column. This would have required the implementation of Inspection Procedure 95003, "Supplemental Inspection for Repetitive Degraded Cornerstone, Multiple Degraded Cornerstones, Multiple Yellow inputs, or One Red Input," at your facility, as well as a number of additional regulatory actions. For the same reasons as those specified for categorizing the violation at Severity Level IV, the NRC also determined that a deviation from the NRC Action Matrix was warranted. In lieu of these actions, we will implement actions as specified in the Licensee Response column because, in this circumstance, this will provide the appropriate level of regulatory response. This deviation from the NRC Action Matrix is documented in a memorandum dated July 25, 2006.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, the July 25, 2006, Action Matrix Deviation Memorandum, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

/RA/

Authur T. Howell III, Director
Division of Reactor Projects

Docket: 50-382
License: NPF-38

Enclosures:
Notice of Violation
NRC Inspection Report 050000382/2006009
w/Attachment: Supplemental Information

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J. Luehman, OE
M. Vasquez
M. Haire
Only inspection reports to the following:
DRS STA **(DAP)**
J. Lamb, OEDO RIV Coordinator **(SCO)**
ROPreports
WAT Site Secretary **(AHY)**

SUNSI Review Completed: __DNG__ ADAMS: / Yes ☐ No Initials:_DNG____
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RIV:SRI:DRS/EB1	NRR	SPE:DRP/D	ACES	C:DRP/E	D:DRP
GDReplogle	MAJunge	MCHay	GMVasquez	DNGraves	ATHowell
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6/16/06 & 6/23/06	6/12/06	6/20/06	8/24/06	8/24/06	8/30/06

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NOTICE OF VIOLATION

Entergy Operations, Inc.
Waterford Steam Electric Station

Docket No. 50-382
License No. NPF-38
EA-06-136

During an NRC inspection conducted on March 6 through May 11, 2006, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

> 10 CFR 50.9 requires, in part; “Information provided to the Commission by a licensee shall be complete and accurate in all material respects.”
>
> Contrary to the above, from approximately November 1, 2004, (when the licensee initially submitted the subject performance indicator information) to May 11, 2006, information provided to the Commission in the form of system unavailability statistics for the high pressure safety injection (Train B) and containment spray (Train B) systems was not complete and accurate in all material respects. The licensee significantly under-reported the unavailability hours for each train. This was material because the NRC used the information to determine its response (e.g., inspection) to the data.

This is a Severity Level IV violation (Supplement VII).

Pursuant to the provisions of 10 CFR 2.201, Entergy Operations is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555 with a copy to the Regional Administrator, Region IV, and a copy to the NRC Resident Inspector at the facility that is the subject of this Notice, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation; EA-06-136" and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC’s document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Dated this 30th day of August, 2006

U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket No.:	50-382
License No.:	NPF-38
Report No.:	05000382/2006009
Licensee:	Entergy Operations, Inc.
Facility:	Waterford Steam Electric Station, Unit 3
Location:	Hwy. 18 Killona, Louisiana
Dates:	March 6 through August 9, 2006
Inspectors:	G. D. Replogle, Senior Reactor Inspector, Division of Reactor Safety M. A. Junge, Mechanical Engineer, Office of Nuclear Reactor Regulation
Approved By:	Arthur T. Howell III, Director, Division of Reactor Projects
ATTACHMENTS:	Supplemental Information

Enclosure 2

SUMMARY OF FINDINGS

IR05000382/2006-009; 03/06/2006-08/09/2006; Waterford Steam Electric Station, Unit 3; Discrepant or Unreported Performance Indicator Data

The report covered a 5 month period of inspection by a Region IV senior reactor inspector and a mechanical engineer from the NRC's Office of Nuclear Reactor Regulation. The inspector identified one Severity Level IV violation, which is not subject to the Significance Determination Process. Findings for which the Significance Determination Process does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July, 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Severity Level IV. The inspector identified a violation of 10 CFR 50.9, with two examples, for the failure to provide accurate information to the NRC associated with the Safety System Unavailably High Pressure Injection and Residual Heat Removal Performance Indicators. The performance indicator information was inaccurate because the licensee improperly concluded that the Train B high pressure safety injection and Train B containment spray systems were still available during an extended period when the containment safety injection sump suction valve was partially open. The inspector found that the licensee had underestimated the size of valve (SI 602B) opening when assessing system availability and failed to address inconsistencies between their field data, diagnostic test data and their own informal calculations. Further, a second analysis performed by a contractor (to determine the as-found valve position) was inadequate, as it contained several errors and inappropriate assumptions. The licensee also provided inadequate contractor oversight with respect to this effort. The erroneous valve position determination resulted in the licensee reporting system availability information that caused the performance indicators to be Green when the High Pressure Safety Injection System Unavailability Performance Indicator should have been Red and the Residual Heat Removal System Unavailability Performance Indicator should have been Yellow.

The failure to provide accurate information to the NRC in accordance with 10 CFR 50.9 requirements was a performance deficiency. The issue had more than minor significance in that, had the information been accurate, two performance indicators would have changed color. Per the NRC Enforcement Policy, Section IV.A.3, these issues are not subject to the Significance Determination Process. The Enforcement Policy, Supplement VII, specifies that a Severity Level III violation would be appropriate for these issues. However, considering: 1) the NRC's recently implemented Mitigating Systems Performance Index program, which would have resulted in the subject performance indicators returning to the Green threshold; and 2) the risk associated with the underlying valve performance issue was of very low safety significance (Green), the NRC determined that a Severity Level IV violation was more appropriate. This finding had problem identification and resolution crosscutting aspects, in that the implementation of the licensee's Corrective Action Program did not result in a thorough evaluation of the identified condition such that information reported to the NRC was verified to be complete and accurate (Section 4OA1).

B. Licensee-Identified Violations

None.

REPORT DETAILS

4OA1 Discrepant or Unreported Performance Indicator Data (71150)

a. Inspection Scope

The purpose of the inspection was to evaluate the accuracy of performance indicator information submitted by the licensee for the High Pressure Injection and Residual Heat Removal Performance Indicators. The accuracy of the performance indicator information was questioned after an operator found containment safety injection sump suction Valve SI-602B partially open on September 9, 2004. This condition could have affected the availability of the Train B high pressure safety injection and Train B containment spray systems. The licensee determined that the valve had been partially open since November 11, 2003, when valve technicians incorrectly set one of the Valve SI-602B limit switches. The partially open valve posed potential challenges to the availability of the noted trains in response to medium break and large break loss of coolant accidents. The availability of the high pressure safety injection system affected the Safety System Unavailability High Pressure Injection Performance Indicator while availability of the containment spray system affected the Safety System Unavailability Residual Heat Removal Performance Indicator.

The inspector reviewed the licensee's evaluation of the as-found valve position, the root cause evaluation report and two contractor-furnished analyses. One contractor had performed an evaluation of system impacts based on different valve positions. The second contractor performed an analysis to determine the valve's as-found position. In addition, the inspector interviewed plant personnel who were involved with issue identification and problem evaluation. Finally, the inspector obtained motor-operated valve drawings and valve test data and performed independent calculations to determine the valve's as-found position.

The underlying valve performance issue was documented as a licensee-identified violation of very low risk significance (Green) in NRC Inspection Report 05000382/2004005, Section 4OA7. Therefore, the focus of this inspection dealt solely with the determination of the accuracy of the data submitted to the NRC regarding the two subject performance indicators.

b. Findings

Introduction. The inspector identified a violation of 10 CFR 50.9, with two examples, for the failure to provide accurate information to the NRC associated with the High Pressure Safety Injection System Unavailability and Residual Heat Removal System Unavailability Performance Indicators. The performance indicator information was inaccurate because the licensee improperly concluded that the Train B high pressure safety injection and Train B containment spray systems were still available during an extended period when the containment safety injection sump suction Valve SI-602B, was partially open. The inspector found that the licensee had underestimated the size of the valve opening when assessing system availability and failed to address inconsistencies between their field data, diagnostic test data and their own informal calculations. Furthermore, a second analysis performed by a contractor to determine the valve's position was inadequate, as it contained several errors and unsupported assumptions. The licensee provided inadequate contractor oversight with respect to this effort. The erroneous valve position determination resulted in the licensee reporting system availability information that caused the two performance indicators to indicate Green when the High Pressure Injection System Unavailability Performance Indicator should have been Red and the Residual Heat Removal System Unavailability Performance Indicator should have been Yellow.

Background: On September 9, 2004, during a system piping integrity test, the test operator found the containment safety injection sump suction Valve SI-602B partially open. The valve is a 24 inch Fisher 9200 series butterfly valve driven by an SMB-00 electric actuator through a quarter turn H2BC gear operator. The licensee determined that the condition had existed since November 11, 2003, when one of the valve limit switches was set incorrectly and prevented the valve disc from reaching the fully closed and seated position.

In response to medium and large break loss of coolant accidents that pressurize containment, the partially open valve posed two potential challenges to system availability. First, the pressurized containment would force air, steam and water through the valve and into the system flow streams. Air entrainment can cause excessive pump vibration and pump air binding which can render the system unavailable. Second, the system suction lines could be pressurized sufficiently as to force and hold closed the refueling water storage pool discharge check Valve SI-107B. This would starve the system pumps of a suction source of water, rendering them unavailable. Depending on the position of SI-602B, this condition had the potential of rendering the high pressure safety injection system Train B, low pressure safety injection system Train B, and containment spray system Train B unavailable. However, in this case, the unavailability of the Train B low pressure safety injection system would not affect a performance indicator value.

The licensee performed a detailed analysis to determine the equipment's sensitivity to air entrainment and suction header pressurization. The licensee determined that the total valve opening could not exceed 0.41 square inches. In addition, the licensee attempted to replicate the valve position and then took physical gap measurements to determine the affected valve disc area. The licensee determined that the open area was 0.25 square inches, which was within the 0.41 square inch acceptance limit. The licensee then took additional valve measurements and determined that the valve's as-found position was approximately 3.2E open. In response to the NRC questions and concerns regarding the valve's actual as-found position, the licensee contracted with an industry engineering firm to again determine the as-found valve position.

Summary: The following bullets summarize the inspector observations and findings. Additional details concerning each identified problem are provided in subsequent sections of this report.

- The licensee's evaluation of system impacts, based on different possible valve positions, was conservative and effective. The evaluation concluded that system availability could be maintained with a maximum valve opening of 0.41 square inches. The inspector had no findings of significance related to this evaluation.

- The licensee's re-creation of the as-found position of Valve SI-602B was inadequate because it failed to account for direction-dependent differences in valve performance. Specifically, valve leakage started and stopped at different handwheel positions depending on whether the valve was being opened or closed. The licensee's re-creation concluded that the valve was 3.2E open.

- A subsequent engineering evaluation performed by a contractor was inadequate because:

  The contractor's evaluation of the licensee's re-creation of the valve's as-found position also failed to account for direction-dependent differences in valve performance. The licensee had not provided the contractor with the pertinent test data. This affected one of five contractor valve position assessments.

  The contractor inappropriately assumed that the valve was over-traveling past the 0E position. The contractor provided no objective evidence to support this assumption and the inspector identified evidence to the contrary. The two calculations that used this assumption concluded that the valve was 3.4E and 3.5E from the 0E position. However, when the inspector applied correction factors to these calculations to account for the erroneous assumption, the calculated valve positions were 5.4E and 5.6E, respectively.

  The contractor used an inappropriate value for the "Modulus of Rigidity" (an engineering term related to the stiffness of a round bar when torque is applied) in one calculation. This made two calculations that were based on different values of handwheel turns (0.55 and 1.0) come to the same final result. This inappropriate factor was used in one calculation but not the other.

  The contractor's estimation of valve position based on HBC operator stop nut measurements was not credible. The data, which was provided by the licensee, was obtained under informal and uncontrolled conditions, was not specific as to the conditions under which it was obtained, and was inconsistent with other information. This affected one contractor calculation.

- The licensee reviewed the contractor's analysis prior to providing it to the NRC but they failed to identify the noted problems.

- The inspector performed two additional independent calculations and determined that the valve's as-found position was slightly greater than 5E from the zero position. The licensee had performed similar calculations and had obtained similar results, but had not formalized these efforts. In addition, the licensee had not attempted to explain the inconsistencies between these calculations and other results that they utilized. The licensee's evaluation of these issues lacked sufficient engineering rigor.

A summary of the calculated valve positions, including inspector corrected values and results from independent NRC calculations, is provided below:

Contractor Calculations and NRC Corrections

Calculation Method/ Referenced Position	**Change in Disc Position from Referenced Position**	**Inspector Corrected Values**
HBC Stop Nut	2.915E	Not Credible, Inconsistent Data
Handwheel Closure (one full handwheel turn)	2.870E	3.9E Least Accurate
Stroke Time Comparison 3/10/1999 Trace (diagnostic system traces)	3.363E	5.4E Reasonable Approximation
Stroke Time Comparison 11/6/2003 Trace (diagnostic system traces)	3.549E	5.6E Reasonable Approximation
Disc Measurement	3.186E	Inadequate Re-creation
Average	**3.177E**	

Independent NRC Calculations

Method	Results	Relative Accuracy
Inservice Stroke Time Tests	5.9E	Reasonable Approximation
Diagnostic System Test Data	5.5E	Most Accurate

The detailed supporting sections of this report are organized into three main categories:

- Assessment of Licensee's Initial Evaluation
- Assessment of Licensee's Contractor Evaluation
- Independent NRC Calculations

<u>Assessment of Licensee's Initial Evaluation</u>

Licensee's First Field Test: The licensee performed field testing to estimate the valve's as-found position.

The first field test was a local leak rate test. The test involved slowly opening the valve using the manual handwheel in 1/8 turn increments to the 2-1/4 turns open position. Then an operator closed the valve in 1/8 turn increments until it was fully closed. The valve operator stated that he did not start counting the handwheel turns until he obtained resistance. That means that the operator did not count the first part of the handwheel operation before the handwheel dogs engaged into the drive sleeve slots. Until the handwheel dogs are engaged, the handwheel would spin freely. The inspector considered this approach appropriate for counting handwheel turns.

The inspector noted that the apparent positions of the valve when leakage started (going open) and stopped (going closed) were sensitive to the direction of valve movement. For example, in the open direction gross leakage initiated between 1-3/8 and 1-1/2 handwheel turns from hard-seat contact. In the closing direction, gross leakage stopped between 7/8 and 3/4 handwheel turn from hard-seat contact. In response to inspector's questions, the licensee stated that they had also noticed this discrepancy but had not attempted to evaluate it.

The inspector reviewed the valve's diagnostic testing system torque traces and determined that the significant difference between the points where leakage started and stopped was due to gear play. The traces revealed that, when the valve changed direction, the motor and gears operate for 1.34 seconds before the valve stem started to move. In the more pertinent part of the trace (from "hammer-blow" to the initiation of valve movement) the time delay was 0.8 seconds. This is the more pertinent trace section because it mimics the valve/actuator response when it is operated with the handwheel. The delay of 0.8 seconds equates to about 0.6 handwheel turn worth of motion, which turns out to be the approximate difference in the handwheel positions noted above.

In reality, for both the opening and closing directions the valve disc was in about the same position when gross flow initiated and stopped. The indicated position in the open direction was misleading because the licensee did not account for the gear play contribution. Accounting for this type of gear play is only necessary when changing the valve's direction and will usually only affect the estimated position (using handwheel turns) in the open direction.

The table, below, illustrates the affect of gear play on the valve position. In this example, the valve in question is repositioned from full closed to 1.8 handwheel turns open. Then the valve is repositioned back to the closed position. For this example, one full handwheel turn is equal to 5.14E of valve movement.

Opening

Handwheel turns from fully closed, going open	Actual valve position in equivalent handwheel turns from fully closed	Valve position in degrees open
0	0	0E
0.2	0	0E
0.4	0	0E
0.6	0	0E
0.8	0.2	1.0E
1.0	0.4	2.0E
1.2	0.6	3.0E
1.4	0.8	4.1E
1.6	1.0	5.1E
1.8	1.2	6.2E

Closing

Handwheel turns from fully closed, going closed	Actual valve position in equivalent handwheel turns from fully closed	Valve position in degrees open
1.8	1.2	6.2E
1.6	1.2	6.2E
1.4	1.2	6.2E
1.2	1.2	6.2E
1.0	1.0	5.1E
0.8	0.8	4.1E
0.6	0.6	3.0E
0.4	0.4	2.0E
0.2	0.2	1.0E
0	0	0E

As demonstrated above, when the valve is being repositioned in the open direction, handwheel position is not an accurate indicator of valve position unless the amount of gear play is known and accounted for. Conversely, moving in the closed direction, once the valve moves through the gear-play region, the handwheel position is a relatively accurate indicator of valve position. This fact is important and has direct ramifications on the licensee's evaluation as discussed below.

Licensee's Second Field Test: The second field test involved positioning the valve to the one handwheel turn open position and taking internal gap measurements. The gap measurements were then used to estimate the approximate valve opening. For clarity, each major step is discussed separately:

1. The licensee opened the valve one full handwheel turn, against resistance, and match-marked the valve's position indicator. The indicator is directly aligned with the valve stem. It is connected to the stem through a splined shaft, which has a small amount of gear play.

   The inspector noted that because of the position error in the opening direction (due to gear play), the valve was not the equivalent of one full handwheel turn open (5.12E) but was about 0.4 handwheel turn open (2E).

2. An operator opened the valve to the 40 percent open position (about 34E).

3. The operator then closed the valve to align the match-markings that were made in the first step. The inspector noted that the licensee had not counted the number of turns back to this position to verify that the valve was actually one handwheel turn from the seat. Instead, the licensee aligned the valve indicator to the match marks that corresponded to the 0.4 handwheel (2E) open position. If there had been no gear play between the indicator and the valve stem, then the valve would have been only 2E open. This gear play between the indicator and the valve stem caused the indicator to lead the actual valve position very slightly. When reversing the valve's direction (going in the closed direction) the gear play would cause the valve to be slightly more open at the match-marked position than when the match-marks were made. Since this gear play constituted only a portion of the total gear play in the valve/actuator system, it was not sufficient to cause the valve to be the equivalent of one full handwheel turn open (5.12E).

4. The licensee took gap measurements between the valve disc and body.

5. The licensee took additional internal measurements and established that the valve disc was approximately 3.2E open.

6. The licensee repeated the procedure and calculated the total valve open area at 0.25 square inches (using the larger of the two measurements). The two measurements were approximately 50% different in magnitude. The licensee identified small gaps between the Tee-Ring and the seat in one lower quadrant and in a small section of one upper quadrant, where the Tee-Ring had torn.

The inspector noted that, between the two tests, the licensee had to reposition the valve to the full closed position in order to start the procedure over for the second set of measurements. The licensee could have easily verified that the valve was actually one full handwheel turn from hard-seat contact at this point in their procedure. The licensee did not perform this verification. If they had done so, then they would have found that the valve was not one full handwheel turn away from the fully closed position.

<u>Assessment of Licensee's Contractor Evaluation</u>

As discussed later in this report, the inspector had performed independent calculations and determined that the valve was slightly more than 5E open. In response to the inspector concerns, the licensee hired a contract engineering firm to evaluate the valve's as-found position. The licensee provided the inspector's with the contractor's report, "Independent Assessment of Disc Position of SI-602B Between November 3, 2003 and September 11, 2004," dated May 8, 2006.

The engineering firm determined that the valve was likely at the 3.2E open position, consistent with the licensee's claims. The engineering firm calculated the valve's position using four different methods, five estimations in all. However, the inspector identified several inappropriate assumptions and errors in the analysis. The following table summarizes the vendor's results as well as the inspector corrected values:

Calculation Method/ Referenced Position	Change in Disc Position from Referenced Position	Inspector Corrected Values
HBC Stop Nut	2.915E	Not Credible, Inconsistent Data
Handwheel Closure (one full handwheel turn)	2.870E	3.9E
Stroke Time Comparison 3/10/1999 Trace (diagnostic system traces)	3.363E	5.4E
Stroke Time Comparison 11/6/2003 Trace (diagnostic system traces)	3.549E	5.6E
Disc Measurement	3.186E	Inadequate Re-creation
Average	**3.177**E	

The inspector findings are discussed in detail below:

HBC Stop Nut Method: This method is based on gap measurements between one of the HBC operator stop nuts and the adjacent enclosure wall. The stop nuts are used in the HBC-2 operator to limit valve travel. While the licensee did not utilize the stop nuts for this purpose, the gap measurements provided some information with respect to the as-found valve position. Most importantly, the stop nut is on the same shaft as the handwheel. Stop nut movement correlates directly with handwheel movement (when the handwheel is engaged). Since the stop nuts had seven threads per inch, one handwheel turn equates to 143 mils in stop nut travel.

The licensee had stated that when the valve was checked, after the operator had closed it, the as-found stop nut gap measurement was 70 mils. After the valve was opened and closed electrically (with the inappropriate limit switch setting) the gap measurement was 150 mils. The licensee then adjusted the valve limit switch until the stop nut measurement was 71 mils. The licensee provided this data to the engineering contractor.

The contractor calculated that the operator had turned the valve handwheel 0.55 turns when he found it. Considering stem deflection (based on the torque at the final valve position being 965 foot-lbs) the contractor's calculated as-found valve position was

2.915E open. The contractor's report indicated that the 0.55 handwheel turns appeared inconsistent with the operator's statements (that he had closed the valve approximately one full handwheel turn).

The inspector noted the following problems and inconsistencies with the data and the contractor's assessment.

- As noted by the contractor, gap measurements did not correlate with operator statements. The HBC stop nut movement should correlate exactly with handwheel movement. The components are on the same shaft. But, the gap measurements indicated that the operator had only turned the valve 0.55 handwheel turn while the operator had indicated that he had repositioned the valve approximately 1 full handwheel turn.

- The HBC gap measurement taken after the operator closed the valve was 70 mils. The gap measurement taken after the valve limit switch was adjusted so that the stop nut gap approximated the same position was 71 mils. These two gap measurements are almost exactly the same. Accordingly, the torque on the valve stem that coincided with each measurement should have been about the same. They were not. The torque value after the operator closed the valve was 965 ft-lbs while the torque value measured after the limit switch was adjusted was 454 ft-lbs.

- The gap measurements were not performed in accordance with procedures and the existing documentation was unclear with respect to what was measured and when it was measured. The licensee had stated that they took gap measurements after each of 15 limit switch adjustments (when they were attempting to properly adjust the value's limit switch on September 11, 2004). However, no data was apparently recorded for 14 of the gap measurements. When asked on more that one occasion for "any and all" documents associated with these gap measurements, the licensee provided only two documents that contained gap values. One document, Work Order 51581 stated, in part:

    > After adjustment 145 mils Desired HW set 70 mils using ETT as AS switched to sts. gap = 71

    The work order contained no steps to take these measurements and the meaning of some of the terminology was not clear. For example, 145 mils was obtained "after adjustment." The document does not state what adjustment was made. Additionally, there was no formally controlled record of the 150 mil value which the contractor used in the calculations (the 145 mil value was not used in the calculations). The 150 mil value was recorded in the computer system but not in the hard copy of the work order.

    The second document, a print of a computer screen (print date May 5, 2006) stated, in part:

    > WO# 51581 150 mils Desired HQ set at 70 mils.

While this document provided some of the same measurement values utilized by the contractor in their calculations, the 150 mil value was inconsistent with the value actually documented in the work order (145 mils after adjustment). In addition, this value was contained in an uncontrolled computer file and was not subject to any quality controls such that it could have been changed in an uncontrolled manner.

- The results from the stop nut measurements were inconsistent with results that the inspector obtained from other calculations, such as those based on diagnostic system torque traces and Inservice Testing stroke times. The time signature data in the diagnostic system torque traces was of a high quality and was very accurate with respect to the identification of artifacts and the time they occurred (provided later in this report).

- A representative from Limitorque informed the inspector that the HBC stop nut threads were 1-1/4 X 7 UNC - coarse. This means, in part, that the stop nut has 7 threads per inch and they are coarse, versus fine or medium grade. The inspector also noted, while inspecting the threads on a much smaller HBC unit, that the stop nuts could move slightly from side to side (without any stop nut rotation). Limitorque had not designed the stop nuts to be used for the purpose of taking precise measurements for the purpose of estimating valve position. They were only provided as a means to stop valve movement. Making precise measurements, to within a few mils, would be very difficult.

Based on the above, the inspector had a low level of confidence in the accuracy of the HBC stop nut gap measurements and it was not clear that calculations based on these values provided meaningful results. Compared to the quality of the other available data, such as the valve torque traces, the HBC stop nut measurements were not credible.

Handwheel Turns: The contractor calculated the as-found valve position based on the operator's statement that he had repositioned the valve approximately one full handwheel turn. The contractor based this calculation on 1.0 handwheel turn (exactly) and then deducted the contribution from stem deflection. Stem deflection is the amount of stem rotation observed without corresponding valve movement (the twisting of the stem due to torque). This would occur when the operator continued to turn the valve's handwheel after the valve disc had contacted the hard-seat.

The inspector identified that the contractor's calculation for stem deflection utilized an inappropriate factor ("torsional stiffness") instead of the standard classical equation that is used for these purposes. This error affected the calculation sufficiently as to make the final result (2.9E from the backseat) appear the same as the calculation based on HBC stop nuts (the contractor had utilized the classical engineering equation in lieu of the torsional stiffness factor in the HBC stop nut calculation). Getting almost exactly the same value in the two calculations was unexpected because the stop nut calculation was based on 0.55 handwheel turn worth of movement while the handwheel turn calculation was based on 1.0 handwheel turn worth of movement. Since the other factors should have been the same, the calculations should have produced different results.

The contractor derived the “torsional stiffness” factor from a portion of the diagnostic system torque trace between hard seat contact and motor-cuttoff. The contractor had performed no validation testing of the torsional stiffness factor to verify that it properly predicted system deflection. The stem deflection equation used by the contractor was:

Stem Deflection = Torque/Torsional Stiffness

The inspector noted that the “torsional stiffness” factor included deflection from all of the actuator/HBC gear trains (including a sliding worm gear in the Limitorque actuator) when only a much smaller portion of the gear train is in service when operating the valve with the handwheel. The inspector observed that the use of the torsional stiffness factor, in lieu of the classical equation, resulted in a higher calculated stem deflection value and a smaller valve opening for the handwheel calculation.

Calculated as-found position = calculated position - stem deflection

Furthermore, the contractor acknowledged that the torsional stiffness factor was not linear, as it appeared to change based on the amount of torque applied to the system. However, the contractor calculated and utilized the value as if it were linear. The contractor used the one calculated value for all circumstances.

The inspector also observed that the contractor had calculated the torsional stiffness for three different closing strokes and had obtained three different results, as provided below:

431 ft-lbs/degree 310 ft-lbs/degree 358 ft-lbs/degree

The relatively large degree of variability in this factor called into question its usefulness in any of the stem deflection calculations. Any factor used to calculate stem deflection should demonstrate good repeatability. The contractor chose to use the 310 ft-lbs/degree value, which also provided the most optimistic (lesser degree of valve opening) results for the “handwheel turn” calculation. The contractor calculated the stem deflection to be:

2.273E

The contractor then calculated the amount of valve opening based on this method as:

5.12E - 2.273 E = 2.9E

NOTE: The contractor also used the torsional stiffness term in their “stroke time” calculations. The effect of using this term in these calculations makes the calculated valve position more open, which is conservative. The magnitude of the adjustment, however, was much smaller, as a much smaller torque difference was applied. As noted later in this report, the contractor had used a different inappropriate assumption in these calculations which made the calculated valve position appear more closed.

Various text and reference books provide a classical equation for calculating the angle of deflection of a round bar with a given torque (for example, “Mechanical Engineering Design,” Fourth Edition, Shigley and Mitchell). Since the stem torque was known (from a direct measurement on the stem) and the diameter, material and length of the stem was also known, the contractor should have utilized the standard equation for this purpose. Considering the configuration of the other components in the affected gear train, deflection of the other components should be negligible. The equation, along with applicable values, is provided below:

Θ = Twist Angle in radians = (T*l)/(G*J)

- T = Torque (use the torque difference in this case) = 705 ft-lbs
- l = Length of Stem = 28 inches
- G = Modulus of Rigidity = 11,500,000 psi
- J = Polar Moment of Inertia = $\pi * d^4/32$ = 0.92
- d = Diameter of Stem = 1.75 inches

The stem deflection based on the above is: 1.27E, compared to the 2.273E used by the contractor. The difference is:

2.27E - 1.27E = 1.0E

Adjusting the contractors calculation to account for this difference, the valve position should be:

2.9E + 1.0E = 3.9E position.

In addition to the above, converting this data to the same units as used in the contractor’s “torsional stiffness” factor, the apparent torsional stiffness using the widely accepted engineering equations would be:

555 ft-lbs/degree, which is substantially greater than the 310 ft-lbs/degree value used by the contractor.

While the inspector agreed that this calculation provided the valve’s position based on the operator’s recollection, the operator had only estimated the amount of handwheel movement at “approximately,” one handwheel turn. The actual amount of travel could have been a little more or a little less. The inspector considered other calculations, based on diagnostic system torque traces, for example, to provide a much higher level of accuracy and confidence.

Stroke Time Measurements: The contractor performed two calculations based on the timing of artifacts in the diagnostic system torque traces. The contractor referred to these as stroke time measurements. These were similar to a calculation performed by the inspector in a later part of this report (Diagnostic System Test Data Method). They should not be confused, however, with another calculation performed by the inspector that was based on Inservice Testing stroke time measurements.

The theory behind the position estimation calculation is that by comparing the as-found (partially open valve) torque trace with a torque trace of the same valve where it did fully close (to the 0E position), the angle of the valve opening with respect to the 0E degree position can be calculated. The inspector agreed that this method of analysis should provide an accurate as-found valve position.

The inspector found that instead of comparing the as-found torque trace to traces where the valve was at the fully closed position, indicated by the presence of hard seat contact on the trace, the contractor had compared the as-found torque trace to other valve traces where the valve did not reach the 0E position. This resulted in significantly under-estimating the valve's position. The contractor used the closing stroke dated March 10, 1999, and the closing stroke dated November 6, 2003, as reference traces.

For the 1999 torque trace, the valve stopped significantly before the 0E position. The inspector calculated the distance that the 1999 valve stroke was from the hard seat by utilizing a trace that was known to reach the 0E position, as evidence by a characteristic shape when the valve reaches the hard seat. Based on this approach, the inspector determined that the valve in the 1999 trace had stopped at the 1.9E position. The valve was leaktight but was still not fully seated. The valve vendor's drawing indicated that the valve could be leak tight out to the 3.2E position. To find the actual as-found valve angle, the inspector added this additional amount of travel to the contractors results.

3.36E + 1.9E = 5.4E

For the November 6, 2003, reference trace, the valve had traveled closer to the valve seat than in the 1999 reference trace. However, the contractor chose a point substantially before the valve had stopped moving as the reference point and treated this point as if it were the 0E position. This reference point was 0.57 seconds short of hard seat contact. That equates to 2.15E degrees of additional travel. Adding this amount to the contractors calculation resulted in:

3.549E + 2.15E = 5.6E

NOTE: For the two calculations above, the inspector neglected any additional adjustment for stem deflection, as the torque in these traces was substantially smaller than in the handwheel case and any additional adjustment would be very small. Additionally, the stem deflection would cause the valve to be slightly more open (making the problem worse, not better).

The inspector determined that the contractor had utilized an inappropriate assumption when performing these calculations. The contractor had assumed that the valve stop was not in the correct position, or was absent altogether, and that the valve was over-traveling past the 0E position. This would make all of the calculated valve opening angles smaller by the amount of over-travel. The contractor's report indicated that the valve was at the 0E position when it was at the first large torque peak and had further stated that this information came from the valve vendor. Some torque traces had two torque peaks (one at the 3.6E position and one at the 2.2E position). The inspector noted that the contractor had no objective evidence to support this claim. In addition, the inspector disagreed with this contention for the following reasons:

- The inspector called the valve vendor and the vendor did not agree that the 0E position was at the first large torque peak. In addition, the vendor indicated that for over-travel to occur, the valve stop set-screw, which is attached to a larger hard stop, would have to be misadjusted or missing. The vendor stated that the set-screw was either staked or welded into position at the factory.

- The licensee had also informed the inspector that they had measured the gap between the set-screw stop and the larger hard stop during the past outage and had verified with the valve vendor that it was the proper size (0.25 inches). This indicated that the valve stop set-screw was in the correct position.

- The inspector reviewed a similar valve trace for the identical valve in Train A, Valve SI-602A. The inspector noted that the valve displayed the same two hump-like features as were evident in the Valve SI-602B traces. If Valve SI-602B was over-traveling past the 0E position, as described by the contractor, both valves were over-traveling. This was not likely, given the vendor information regarding set-screw installation.

- As a bounding exercise, if the set-screw was totally missing, the valve could only travel an additional 0.25 inches at the outer edge. That equates to only an additional 1.2 degrees of valve travel. The inspector calculated the angular distance between the large hump and the hardseat (without correction for stem deflection at 3.6E). In other words, the hump was too far from the hard stop for this theory to be credible.

<u>**Independent NRC Calculations**</u>

The inspector used the licensee’s test data and two calculation methods to determine the as-found position of Safety Injection Valve SI-602B. Based on the calculations, the inspector determined that the valve was open slightly more than 5E, which was significantly more than the 3.2E assumed in the licensee’s analysis. The following table provides a summary of the results:

Method	Results	Relative Accuracy
Inservice Stroke Time Tests	5.9E	Reasonably Accurate
Diagnostic System Test Data	5.5E	Most Accurate

The calculations are provided below:

- **NRC Calculation 1: Based on Inservice Stroke Time Tests:** Since the inappropriate limit switch setting also affected the valve’s stroke time, the inspector calculated the valve position based on the difference in the recorded stroke times. The inspector compared the average of the stroke times when the limit switch was set incorrectly to the average of the stroke times when the limit switch was set properly.

Stroke Times (Close Direction), Limit Switch set Incorrectly:

11/7/2003	22.2 Seconds
1/6/2004	22.5
3/30/2004	22.5
6/25/2004	22.5

Average = 22.4 Seconds

Stroke Times (Close Direction), Limit Switch set Properly

9/11/2004	23.9
12/7/2004	23.7
3/1/2005	24
5/25/2005	24
6/16/2005	23.9
8/16/2005	23.9
8/17/2005	23.9
11/8/2005	23.8
1/31/2006	24.2

Average = 23.9 Seconds

Calculate Difference in Averages

= 23.9 - 22.4 = 1.5 seconds

Calculate Valve Speed in Degrees per Second (based on 1800 RPM motor speed)

- Given Information:
  - Limitorque actuator overall ratio (OAR) = 41.0
  - Limitorque HBC operator ratio = 70
  - Motor speed = 1800 rpm (based on motor speed curve)
- Calculate the time for the valve to rotate 90E:

  ((41*70) motor rev. per valve rev.)(60 seconds per minute)(90E)
  (1800 motor revolutions per min)(360E)

  = 23.9 seconds
- Determine the valve speed in degrees per second:

  = (90E)/(23.9 seconds) = 3.77E/second

Calculate the Difference in Valve Travel (based on valve speed and difference in stroke times)

= (1.5 seconds) * 3.77E/second = 5.66E open

Calculate Stem Deflection Adjustment (from stem torque traces)

- T = Stem Torque Difference, Between As-Found Torque when Partially Open (285 foot-lbs) and the Torque when Valve Disc Starts to Move (150 foot-lbs)

  = 265 - 150 = 115 foot lbs

- I, d, G and J are the same as used in an earlier calculation.

Based on the above,

Θ = (115 foot-lbs * 28 inches * 12 inches/foot)/(11,500,000 psi*.92)

= 0.00365 radians * (180E/π radians) = 0.21E

Calculate Valve Opening Based on the Difference in Inservice Stroke Times

Since stem deflection causes the valve disc to lag slightly, stem deflection affect causes the valve to be slightly more open.

= 5.66E + 0.21E = 5.87E . **5.9E**

The accuracy of this calculation is affected by the method used for measuring the individual stroke times. When testing the valve, operators used a stop watch. There is some variability in operator response times when stopping the watch. This uncertainty is limited to some degree because the calculation uses the difference in the average stroke times, versus comparing any two points directly. Considering that the data scatter was very limited, the response times for the opening and closing tests should approximately cancel each other in the calculation. Therefore, this calculation should provide a reasonable estimation of valve position.

- **Calculation 2: Based on VOTES Torque Traces:** This method of approximation utilizes data taken directly from diagnostic system torque traces. Diagnostic system torque traces are very accurate when identifying the location of artifacts in the traces with respect to time. Artifacts such as the start of valve movement and the point where the valve disc hits the hard seat are easily identified by commonly known characteristic shapes on the traces. Accordingly, the timing between artifacts, which is performed in this calculation, is easily determined and the results are very accurate. When combined with relatively minor adjustments to account for stem deflection and valve coastdown (the amount of valve travel after the motor is de-energized), the final calculated valve position is very accurate when compared to other estimation methods.

The inspector considered this method the most accurate of all of the approximation methods used in this report.

Given Information:

- Limitorque actuator overall ratio (OAR) = 41.0
- Limitorque HBC operator ratio = 70
- Motor speed = 1800 rpm
- Valve Speed = 3.77 degrees/second (calculated earlier)

NOTES:

1. The calculation assumes that the 1800 rpm motor experiences no slippage. This is generally a safe assumption considering the applicable part of the motor curve (torque = less than 1 foot pound). As part of a sensitivity analysis, however, the inspector also performed a calculation assuming worst case slippage (the motor rotates at 1775 rpm). This is considered more than bounding for this problem.

2. The inspector used data from two motor-operated valve torque traces. In one trace (2005), the closing limit switch was set properly while in the other (2003) the limit switch was set short of the target (and is the genesis of the discrepant PI inspection).

Part A: Determine the size of the valve opening (in degrees) in 2003 when the limit switch was set incorrectly (based on 1800 revolutions per minute motor speed).

1. Determine the valve travel time when the limit switch was set correctly (information from 2005 MOV torque trace):

   Time valve starts moving (from MOV trace) = 1.36 seconds
   Time close limit switch opens = 23.55 seconds
   Travel time = 23.55 - 1.36 = 22.19 seconds

2. Calculate the distance traveled (in degrees) when limit switch was set correctly:

   (22.19 sec)(3.77E/second) = 83.7E

   Therefore, when the valve was full open, it was 83.7E away from hard seat contact.

3. Determine the valve travel time when the limit switches were set incorrectly (information from 2003 MOV torque trace):

   Time valve starts moving (from MOV trace) = 1.34 seconds
   Time close limit switch opens = 22.02 seconds
   Travel time = 22.02 - 1.34 = 20.7 seconds

4. Calculate the distance traveled (in degrees) when the limit switch was set incorrectly:

   (20.7 sec)(3.77E/second) = 78.0E

5. Calculate the valve's open angle (in degrees) from the seat when the closing limit switch opened in 2003:

   = total distance traveled in 2005 (from full open to seat) - total distance traveled in 2003

   = 83.7E - 78.0E = 5.7E

6. Determine the time that the valve continued to move after the closing limit switch contact opened (2003 trace):

   Limit switch opened at 22.02 seconds
   Valve stopped moving at 22.22 seconds
   Time of additional travel = 22.22-22.02 = 0.2 seconds

   The most that the valve could have continued to travel was:

   (0.2 seconds)(3.77E) = .75E

   Since the valve was not traveling at full speed for the entire time, but was, instead, slowing to a stop, use ½ of the above.

   ½ * .75E = .38E

7. Determine the 2003 distance from the seat considering additional valve coasting after the limit switch contact opened:

   = 5.7E - .38E = 5.3E

8. Adjust for Stem Deflection (use same value as in NRC Calculation 1)

   5.3E + .21E = **5.5E**

Part B (sensitivity case): Determine the size of the valve opening in 2003 when the valve closing limit switch was set incorrectly (assuming 1775 revolutions per minute motor speed, maximum slippage).

Part B was completed in exactly the same manner as Part A above, with the exception that the motor speed was changed from 1800 revolutions per minute to 1775 revolutions per minute. The resultant valve angle was:

5.3E

The inspector asked the plant's engineers if they had performed other calculations similar to those performed in this report (by the inspector) to determine valve position. The engineers stated that they had performed similar calculations and that they had obtained similar results (the valve was approximately 5E open). However, the engineers did not formalize these calculations or formally address the inconsistencies between their field data, the diagnostic system data and the calculations.

Performance Indicator Conclusions

During the first 2 years of Reactor Oversight Process implementation, NRC staff and industry identified problems with the safety system unavailability performance indicators and worked to implement incremental changes to the indicators. Over the next 4 years, a working group developed a performance indicator that addressed the identified problems. This indicator, the Mitigating System Performance Index, was implemented April 1, 2006, and is addressed in NRC Regulatory Issue Summary 2006-07, "Changes to the Safety System Unavailability Performance Indicators."

Based on a valve opening of approximately 5E, which is a close approxiation of the degree of valve opening as determined by the NRC, the Train B high pressure safety injection and both Train B containment spray pumps were unavailable between November 11, 2003, and September 9, 2004, for a range of medium and large break loss of coolant accidents. The licensee calculated the maximum tolerable valve opening area at 0.41 square inches. According to the valve vendor, a valve opening of 5E corresponded to an opening size of 3.16 square inches, over 7 times the acceptable opening.

The inspector determined that the High Pressure Injection and Residual Heat Removal Performance Indicator information provided to the NRC was not accurate. Based on revised data, the High Pressure Injection Performance Indicator should have been Red while the Residual Heat Removal Performance Indicator should have been Yellow up until the point that the safety system unavailability performance indicators were replaced by MSPI on April 1, 2006. Specifically, revising the reported performance indicator data to reflect the appropriate system unavailability would have caused the High Pressure Injection Unavailability Performance Indicator to turn White in the fourth quarter of 2003 with a value of 2.5%, Yellow in the first quarter of 2004 with a value of 6.9%, and Red in the second quarter of 2004 with a value of 11.2%. The indicator would have remained Red until the changeover to MSPI on April 1, 2006. The Residual Heat Removal System Unavailability Performance Indicator, which includes Containment Spray, would have turned White in the first quarter of 2004 with a value of 3.6%, and Yellow in the second quarter of 2004 with a value of 5.8%. The Indicator would have remained Yellow until the changeover to MSPI on April 1, 2006.

Analysis. The failure to provide accurate information to the NRC in accordance with 10 CFR 50.9 requirements was a performance deficiency. The issue had more than minor significance because, had the information been accurate, two performance indicators would have changed color. Per the NRC Enforcement Policy, Section IV.A.3, these issues are not subject to the Significance Determination Process. In determining the violation's severity level, the NRC considered a recent revision to the Mitigating Systems Performance Indicators. Specifically, under the revised process fault exposure hours would not be counted and the affected performance indicators would return to the Green performance level. Additionally, the initial performance deficiency, Valve SI-602B being left slightly open, had been evaluated under the Significance Determination Process and found to be of very low safety significance (Green). Following identification of the mis-positioned valve, the licensee promptly placed the valve in the correct position which reestablished the functionality of the affected systems. The licensee conducted a root cause evaluation of the underlying performance deficiency, and took actions to ensure that the condition was not present on similarly operated valves. Field verifications were conducted to ensure that similar valves were in fact, fully closed. Accordingly, the NRC concluded that the concerns are more consistent with a Severity Level IV violation in lieu of the Severity Level III recommendation made in the Enforcement Policy (Supplement VII). This finding had problem identification and resolution crosscutting aspects in that the licensee's Corrective Action Program did not thoroughly evaluate the identified condition such that information reported to NRC was verified to be complete and accurate.

Enforcement. 10 CFR 50.9 requires, in part, that "Information provided to the Commission... by a licensee... shall be complete and accurate in all material respects." Contrary to the above, from approximately November 1, 2004 (when the licensee initially submitted the information) to May 11, 2006, information provided to the Commission in the form of unavailability statistics, for the Train B high pressure safety injection and Train B containment spray systems, was not complete and accurate in all material respects. The licensee significantly under-reported the unavailability hours for each train. This violation did not qualify for consideration as a noncited violation because the violation did not meet the Enforcement Policy, Section VI.A.1.a criterion in that the noncompliance was not corrected within a reasonable time following the identification of the violation. For the purposes of this criterion, the violation was identified on the inspection exit debrief date of May 11, 2006. As of the date of this inspection report issuance, the licensee had not corrected the inaccurate information (NOV 05000382/2006009-01).

4OA6 Meetings, Including Exit

Exit Meeting Summary

On May 11, 2006, the senior reactor inspector presented the inspection results to Mr. Kevin Walsh, General Manager, Plant Operations and other members of the licensee's staff, who acknowledged the findings. The inspector updated the licensee by telephone on June 23, 2006, with respect to proposed enforcement conclusions. A final telephonic exit meeting was conducted on August 9, 2006, with respect to a subsequent review of additional information provided by the licensee. The conclusions remained the same. Some proprietary information was reviewed during the inspection but none of the information was documented in this report.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Venable, Vice President, Operations
T. Gaudet, Manager, Quality Assurance
A. Harris, Acting Director, Nuclear Safety Assurance
J. Holman, Manager, Nuclear Engineering
B. Lanka, Supervisor, Engineering Design
T. Mitchell, General Manager Plant Operations, Arkansas Nuclear One
R. Murillo, Manager, Licensing
R. Osborn, Manager, Engineering Programs and Components
K. Peter, Manager, Design Engineering
P. Stanton, Supervisor, Engineering Programs and Components
T. Tankersley, Director, Safety Assurance
K. Walsh, General Manager, Plant Operations
B. Williams, Director, Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000382/2006009-01	NOV	Inaccurate Performance Indicator Information

LIST OF DOCUMENTS REVIEWED

Condition Reports

CR-WF3-2000-00048 CR-WF3-2004-02847 CR-WF3-2006-01567

Drawings

52B8124, "24 body, SMB-00-HBC-1 Actuator Limitorque - 9200 Electric Actuated Control Valve," Revision B

Various piping and instrumentation diagrams for the safety injection and containment spray systems

K11131, "Cross-Section Adjustable Elastomer Tee Ring in Disc Edge," dated February, 1972

"Butterfly Valve Information Sheet," Sheet B-3, dated October 10, 1995

Vendor supplied drawing of valve configuration, no date, title or revision number

Work Orders

51581 55621 66541 50686649

Miscellaneous

- MPR draft letter report titled "Waterford Unit 3 Safety Injection and Containment Spray System Air Entrainment Reanalysis for Large and Medium Break LOCA," dated February 21, 2006.

- Licensee document No. 2493C, Rev. 1, Appendix D: Response to NRC Comments of May 11, 2006

- MPR-2758, "Waterford 3 Safety Injection and Containment Spray Systems Past Availability Evaluation," Revision 0

- Calculation Number ECM05-007, "Waterford 3 Safety Injection and Containment Spray Systems Past Availability Evaluation for Medium Break LOCA," Revision 0

- Calculation Number ECM05-006, "Waterford 3 Safety Injection and Containment Spray Systems Past Availability Evaluation," Revision 0

- Root Cause Analysis Report, "SI-602 B Not Fully Seated," CR-WF3-2004-2847, Dated September 9, 2004, Report Date: November 10, 2004.

- MPR-2469, Appendix J, "Verification of Hydraulic Analysis Program," Revision 0

- Various safety injection Valve SI-602A and SI-602B motor-operated valve VOTES traces, dated November 6, 2003; September 11, 2004; May 5, 2005; May 7, 2005; and May 12, 2005

- White Paper, "Standard of Proof for Assessing Past Operability," no date

- Limitorque AC Motor Curve, 10 Ft-Pound motor

- STI-W3-2005-0004-00. "Special Test Instructions (STI): Leak Rate Test of SI-602B," performed on May 25, 2005

- Informal calculation to determine as-found backpressure, assuming 0.25 square inch opening, no date

- Table of trended Inservice Test data for Valve SI-602B, no revision or date

- Estimated valve opening areas for 4E and 5E open positions, dated April 4, 2006

- "Independent Assessment of Disc Position of SI 602B between November 3, 2003, and September 11, 2004," dated May 8, 2006, Kalsi Engineering