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NP-33-97-008-3
AB-97-0103

Docket No. 50-346

License No. NPF-3

June 16, 1997

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Ladies and Gentlemen:

LER 97-008, Revision 3
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence - March 18, 1997

Enclosed please find Revision 3 to Licensee Event Report (LER) 97-008, which is being submitted to provide additional information regarding the subject occurrence. The changes are marked with a revision bar in the margin. Please destroy or mark superseded on previous copies of the LER. This LER is being submitted in accordance with 10CFR50.73(a)(2)(i)(B).

Very truly yours,

James H. Lash
Plant Manager
Davis-Besse Nuclear Power Station

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DLM/dlc

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Enclosure

cc: Mr. A. B. Beach
Regional Administrator
USNRC Region III

Mr. Stan Stasek
DB-1 NRC Sr. Resident Inspector

Utility Radiological Safety Board



230053

Operating Companies
Cleveland Electric Illuminating
Toledo Edison

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-8 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Davis-Besse Unit Number 1		DOCKET NUMBER (2) 05000346	PAGE (3) 1 OF 10
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TITLE (4)
Inadequate Testing of Safety Related Logic

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	18	97	97	-- 008 --	03	06	16	97	FACILITY NAME	DOCKET NUMBER
										05000
										05000

OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
POWER LEVEL (10) 100	20.2201(b)	20.2203(a)(2)(v)	X	50.73(a)(2)(i)	50.73(a)(2)(viii)					
	20.2203(a)(1)	20.2203(a)(3)(i)		50.73(a)(2)(ii)	50.73(a)(2)(x)					
	20.2203(a)(2)(i)	20.2203(a)(3)(ii)		50.73(a)(2)(iii)	73.71					
	20.2203(a)(2)(ii)	20.2203(a)(4)		50.73(a)(2)(iv)	OTHER					
	20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A					
	20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)						

LICENSEE CONTACT FOR THIS LER (12)

NAME Gerald M. Wolf, Engineer - Licensing	TELEPHONE NUMBER (Include Area Code) (419) 321-8114
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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
X YES (if yes, complete EXPECTED SUBMISSION DATE)	NO						

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

During a review as requested by Generic Letter 96-01, "Testing of Safety-Related Logic Circuits," the following conditions were discovered where approved Surveillance Test procedures did not completely meet the applicable Surveillance Requirements:

1. The monthly Surveillance Tests for the Safety Features Actuation System (SFAS) and for the Anticipatory Reactor Trip System did not provide a complete check of the two-out-of-four logic gates in the individual output modules.
2. The Surveillance Tests for the SFAS did not verify that equipment with an alternate or swing components were load shed or energized through the emergency diesel generator load sequencers every 18 months.
3. SFAS logic was not response time tested at the Technical Specification Surveillance Requirement specified frequency.

These conditions represent conditions prohibited by the plant's Technical Specifications, and are therefore being reported in accordance with 10CFR50.73(a)(2)(i)(B). Testing was performed to verify equipment operability, and the appropriate testing will continue to be performed on the required frequency. Review of safety-related logic circuits as requested by Generic Letter 96-01 is ongoing, and any future Surveillance Test deficiencies discovered as a result of this review will be reported in supplements to this Licensee Event Report.

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

Description of Occurrence:

On January 10, 1996, the NRC issued Generic Letter 96-01. This Generic Letter requested licensees take the following actions:

- 1) Compare electrical schematic drawings and logic diagrams for the reactor protection system, emergency diesel generator load shedding and sequencing, and actuation logic for the engineered safety features systems against plant Surveillance Test procedures to ensure that all portions of the logic circuitry, including the parallel logic, interlocks, bypasses and inhibit circuits are adequately covered in the Surveillance procedures to fulfill the Technical Specification requirements. This review should also include relay contacts, control switches, and other relevant electrical components within these systems, utilized in the logic circuits performing a safety function.
- 2) Modify the Surveillance procedures as necessary for complete testing to comply with the Technical Specifications. Additionally, the licensee may request an amendment to the Technical Specifications if relief from certain testing requirements can be justified.

Completion of these actions was requested to be accomplished prior to startup from the first refueling outage commencing one year after the issuance of the Generic Letter. In a letter dated April 16, 1996, (Serial Number 2370), Toledo Edison committed to completing this review prior to startup from the eleventh refueling outage, which is currently scheduled to start in April 1998. During this review, the following conditions were discovered.

Condition 1: A review of the Safety Features Actuation System (SFAS) [Energy Industry Identification System Code: JE] was conducted. Davis-Besse's Technical Specifications state that each SFAS output logic functional unit shall be demonstrated operable by performing a monthly channel functional test in Modes 1-4 and in Mode 6 if using the SFAS area radiation monitors to support core alterations or movement of irradiated fuel within containment. The Technical Specifications also specify an 18 month channel calibration and a shiftly channel check for these same functional units. On March 18, 1997, at 1015 hours with the plant in Mode 1 operating at 100 percent power, it was determined that the Technical Specification requirement for an 18 month calibration of all SFAS output logic is equivalent to the Technical Specification requirement to perform a monthly channel functional test. The existing monthly functional tests do not provide a complete check of the two-out-of-four logic gates in the individual SFAS output modules. The 18 month Surveillance Test performs a check of the logic gates not checked in the monthly channel functional tests. Since the existing monthly functional tests did not provide a complete check of the two-out-of-four logic gates in the individual SFAS output modules, the Technical Specification Surveillance Requirements were not being met. The last time these

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Description of Occurrence: (Continued)

Surveillance Requirements were met was on November 20, 1996, when the 18 month test was performed. Since the Surveillance Requirements were not met in the appropriate time frame, the plant was being operated in a condition that was prohibited by the plant's Technical Specifications. This placed the plant in Technical Specification 3.0.3, which requires actions to be initiated within one hour to place the unit in a Mode in which the Specification does not apply. The 24 hour time period permitted by Technical Specification 4.0.3 was invoked to allow completion of the 18 month Surveillance Test. The 18 month test was completed on March 18, 1997, at 1300 hours, demonstrating that all channels of SFAS were operable; therefore, the plant exited Technical Specification 3.0.3.

Condition 2: Because of the discovery of condition 1, a review of the Anticipatory Reactor Trip System (ARTS) was conducted. Davis-Besse's Technical Specifications state that each ARTS output logic functional unit shall be demonstrated operable by performing a monthly channel functional test in Mode 1. On April 3, 1997, at 1331 hours with the plant in Mode 1 operating at 100 percent power, it was determined that the refueling interval periodic testing of all ARTS output logic is equivalent to the Technical Specification requirement to perform a monthly channel functional test. The existing monthly functional tests do not provide a complete check of the two-out-of-four logic gates in the individual ARTS output logic. Every refueling outage, a non-Technical Specification required interchannel logic test is performed to check the logic gates not checked in the monthly functional tests. Since the existing monthly functional tests did not provide a complete check of the two-out-of-four logic gates in the ARTS output logic, the Technical Specification Surveillance Requirement was not being met. The last time a complete check of the ARTS output logic was performed was on May 20, 1996, when the interchannel logic test was performed. Since the Surveillance Requirement was not met in the appropriate time frame, the plant was being operated in a condition that was prohibited by the plant's Technical Specifications. This placed the plant in Technical Specification 3.0.3, and the 24 hour time period permitted by Technical Specification 4.0.3 was invoked to allow performance of an interchannel logic test. Testing was completed on April 3, 1997, at 1718 hours, demonstrating that all channels of ARTS were operable; therefore, the plant exited Technical Specification 3.0.3.

Condition 3: A review of the emergency diesel generator [EK] load shedding and sequencing circuitry was conducted. Davis-Besse Technical Specification 4.8.1.1.2.d.2 (a. & b.) states that each diesel generator shall be demonstrated operable by simulating a loss of offsite power in conjunction with a SFAS test signal every 18 months and verifying (a) de-energization of the essential busses and load shedding from the essential busses, and (b) the diesel starts on the auto-start signal, energizes the essential busses with permanently connected

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Description of Occurrence: (Continued)

loads, energizes the auto-connected loads through the load sequencer, and operates for greater than or equal to 5 minutes while its generator is loaded with the essential loads. On May 12, 1997, at 1455 hours with the plant in Mode 5, it was determined that this Technical Specification requirement was not completely satisfied because all required loads were not verified to be load shed or verified to be energized through the load sequencer every 18 months. Specifically, the equipment with an alternate or swing component (such as Component Cooling Water Pump 3, Service Water Pump 3, and Containment Air Cooler 3) was only tested on an alternating outage periodicity under the SFAS integrated time response test. This test was written to check train 1 and train 2 components during one refueling outage, and then check the swing components as train 1 and train 2 components during the subsequent outage. Based on testing done by other procedures, only the following two conditions were not properly tested within the required time frame: loading logic of Component Cooling Water Pump 3 aligned as pump 1, and load shedding of Service Water Pump 3 aligned as pump 1 and as pump 2. Since all necessary components were not tested every 18 months, the Technical Specification Surveillance Requirements were not being met within the appropriate time frame. Further reviews completed on May 16, 1997, at 1105 hours with the plant in Mode 5, determined that testing of Component Cooling Water Pump 3, aligned as Pump 1, shall be completed to satisfy Surveillance Requirement 4.7.3.1.b.2. This surveillance requirement also verifies that each component cooling water pump starts automatically on an SFAS test signal. The last time that portions of the circuitry, not tested within the last 18 months, were tested satisfactorily was on November 5, 1994. These circuits were successfully tested on May 16, 1997, demonstrating that this circuitry was operable prior to the plant entering Mode 4 and was in compliance with both surveillance requirements.

Condition 4: A review of the SFAS Level 5 actuation circuitry was performed. Davis-Besse's Technical Specifications state that the Safety Features response time of each SFAS function shall be demonstrated to be within the limit at least once per 18 months. Each test shall include at least one functional unit such that all functional units are tested at least once every N times 18 months, where N is the total number of redundant functional units for a specific SFAS function. On May 14, 1997, at 1615 hours with the plant in Mode 5, it was determined that an SFAS output logic functional unit begins at the output of the bistable isolators. With this interpretation, it was determined that the SFAS logic, consisting of at least the output modules, had not been response time tested at the frequency specified in Surveillance Requirement 4.3.2.1.3. Specifically, the response time of output logic functional units for Incident

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Description of Occurrence: (Continued)

Levels 1 through 4 for SFAS channels 3 and 4 had not been tested within the appropriate Technical Specification Surveillance Requirement time frame. The last time the response times for these SFAS channel 3 and 4 instruments were tested satisfactorily was during the 1991 to 1993 time frame. Response time testing was completed on May 14 through 17, 1997, demonstrating that all channels of SFAS were operable prior to the plant entering Mode 4.

All of these events represent conditions prohibited by the plant's Technical Specifications, and are therefore being reported in accordance with 10CFR50.73(a)(2)(i)(B).

Apparent Cause of Occurrence:

Conditions 1 and 2: Licensee Event Report (LER) 85-021, submitted to the NRC on December 2, 1985, identified the System Review and Test Program SFAS review revealed a portion of the two-out-of-four SFAS output logic was not tested regularly. This output logic was tested prior to initial plant operations. The apparent cause was that the Surveillance Test review process was not technically detailed enough to ensure that all functions of all components were being addressed. The condition was reported as a procedure inadequacy that could have allowed the failure of a component in a safety system to go undetected. Testing of the logic gates was conducted as part of the System Review and Test Program. Subsequently, a Surveillance Test was developed to test these logic gates on an 18 month frequency. At this time it was believed that not all logic gates were required to be tested to satisfy the Technical Specification monthly channel functional test Surveillance Requirement, as evidenced by prescribing testing on an 18 month frequency.

LER 88-020, submitted to the NRC on September 16, 1988, identified ARTS and SFAS monthly channel functional testing did not completely meet Technical Specification Surveillance Requirements 4.3.2.3 and 4.3.2.1.1. The apparent cause was that the testing provisions provided in the vendor drawings did not facilitate monthly testing of those portions of a coincidence logic circuit that receive an actual (i.e., other than test) demand. This condition occurred, in part, because the circuits were not wired per logic drawings (design drawing), but instead were wired per the vendor drawings. The LER recognized the SFAS gates that were not tested in the monthly channel functional test were tested in the 18 month integrated SFAS testing. The condition was reported as a condition prohibited by the plant's Technical Specifications. ARTS and SFAS logic wiring were corrected to allow monthly testing per the original design intent.

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Apparent Cause of Occurrence: (Continued)

LER 91-001, submitted to the NRC on April 10, 1991, identified the Reactor Protection System (RPS) [Energy Industry Identification System Code: JC] monthly channel functional testing did not completely meet Technical Specification Surveillance Requirement 4.3.1.1.1. Prior to 1981, the test procedure included steps to verify that all combinations of the trip logic were tested. In 1981, the test procedure was revised and the measurement of voltage to each Control Rod Drive trip device was eliminated as it was deemed unnecessary. The apparent cause of this procedure deficiency was inadequate technical review. No further checks of other systems, such as ARTS and SFAS, were performed at this time to determine if the existing Surveillance Tests satisfied the Technical Specification Requirements. This was based upon the review that was performed in 1988 for LER 88-020. However, the review performed for LER 88-020 was incomplete due to a lack of understanding of the full intent of the definition of a channel functional test, and due to the belief that the existing licensing bases supported the existing methods used to accomplish Surveillance Tests.

The apparent cause for conditions 1 and 2 is personnel error in failing to fully understand the Technical Specification Surveillance Requirements for a channel functional test as applied to channel output logic. Technical Specification Definition 1.11, Channel Functional Test, identifies a channel functional test to be the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify operability, including alarm and/or trip functions for analog channels, and the injection of a simulated signal into the channel sensor to verify operability, including alarm and/or trip functions for bistable channels. The ARTS and SFAS monthly channel functional tests do inject a simulated signal into the channel output logic to verify the channel output logic trip function. However, the monthly channel functional tests did not satisfy the applicable Surveillance Requirement because the tests did not functionally verify the operability of all components that could complete the logic and cause a trip in the ARTS or SFAS output logic. A contributing factor is the generic nature of the Technical Specification definition of the channel functional test and the application of the definition to channel output logic.

Condition 3: The apparent cause for condition 3 is personnel error in that the requirement to test all components (including swing components) was never considered a strict surveillance requirement. Testing one component per train was previously considered adequate. There is clearly no exception stated in the Technical Specifications that allows excluding the logic circuits of the alternate components.

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Apparent Cause of Occurrence: (Continued)

Condition 4: The apparent cause for condition 4 is personnel error during development of the response time Surveillance Tests. The inconsistency between the Technical Specification functional unit labels and the Updated Safety Analysis Report descriptions of SFAS channels led to the test procedure preparers misunderstanding the Technical Specification requirements.

Based on the number of events discovered resulting from the Generic Letter 96-01 Review Program, a multi-discipline team is being assembled to identify the overall root cause. This multi-discipline team will evaluate the apparent cause of all events discovered under the Generic Letter 96-01 Review Program in determining the overall root cause.

Analysis of Occurrence:

Conditions 1 and 2: The portions of the output logic circuits for ARTS and SFAS that were not tested in the past during monthly testing are part of integrated circuits and solid state components. Past experience has shown that these components are highly reliable. Multiple failures in redundant components are required to prevent the system from tripping during actual demands for system actuation. In no case was the capability of manually tripping the logic circuits compromised. Operator training on the plant's simulator emphasizes manual initiation of a safety system when automatic initiation does not occur. All of the logic circuits for SFAS that were not tested during monthly testing were previously tested satisfactorily on November 20, 1996, by performance of the 18 month Surveillance Test. Performance of the 18 month Surveillance Test on March 18, 1997, revealed no equipment deficiencies. Based upon this successful test, it is concluded that plant safety was not compromised. Results from previous performances of the 18 month Surveillance Test determined that SFAS was capable of performing its designated safety function at the time of the test. All of the logic circuits for ARTS that were not tested during monthly testing were previously tested satisfactorily on May 20, 1996, by performance of the interchannel logic test. Performance of the interchannel logic test on April 3, 1997, revealed no equipment deficiencies. Based upon this successful test, it is concluded that plant safety was not compromised. Results from previous performances of the interchannel logic test determined that ARTS was capable of performing its designated safety function at the time of the test.

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Analysis of Occurrence: (Continued)

Condition 3: The portions of the emergency diesel generator load shedding and sequencing circuitry, not tested within the last 18 months, were previously tested satisfactorily on November 5, 1994, by performance of the 18 month Surveillance Test. Testing of these circuits on May 16, 1997, revealed no equipment deficiencies. Based upon this successful test, it is concluded that plant safety was not compromised. Results from previous performances of the 18 month Surveillance Test indicated that the emergency diesel generator was capable of performing its designated safety function at the time of the test.

Condition 4: All of the logic circuitry for the sensor parameters that were not tested within the specified Surveillance Requirement was previously tested satisfactorily during the 1991 to 1993 time frame by performance of the applicable Surveillance Tests. Response time testing of these circuits on May 14 through May 17, 1997, revealed no equipment deficiencies. Based upon this successful test, it is concluded that plant safety was not compromised. Results from previous performances of the applicable Surveillance Tests determined that the logic circuitry was capable of performing its designated safety function at the time of the test.

Therefore, even though portions of the affected systems were not tested monthly in accordance with the Technical Specification Surveillance Requirements, these events had minimal safety significance.

Corrective Actions:

Condition 1: On March 18, 1997, the 18 month Surveillance Test (DB-SC-03115, SFAS Interchannel Logic Test) was performed and completed satisfactorily with no equipment deficiencies. The combination of this test and the existing monthly tests provide an overlapping check of all required two-out-of-four logic in the output modules of SFAS. The 18 month Surveillance Test will continue to be performed on a monthly frequency along with the monthly tests so that a complete check of the two-out-of-four logic gates in the individual SFAS output modules is performed.

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Corrective Actions: (Continued)

Condition 2: On April 3, 1997, the interchannel logic test (DB-MI-03355, ARTS Interchannel Logic Test) was approved, performed, and completed satisfactorily with no equipment deficiencies. The combination of this test and the existing monthly tests provide an overlapping check of all required two-out-of-four logic in the output logic of ARTS. The interchannel logic test will continue to be performed on a monthly frequency along with the monthly tests so that a complete check of the two-out-of-four logic gates in the individual ARTS output logic is performed. Additionally, the existing periodic test (DB-MI-04020), written to be performed in an outage, will be changed to a surveillance test and performed prior to entering Mode 1 after every refueling outage, as required by the Surveillance Test schedule.

Condition 3: On May 16, 1997, the portions of the emergency diesel generator load shedding and sequencing circuitry that had not been tested within the last 18 months were tested satisfactorily with no equipment deficiencies. This testing in combination with other Surveillance Testing provided an overlapping check of all the required circuitry. The 18 month Surveillance Test (DB-SC-03114, SFAS Integrated Time Response Test) will be revised to incorporate logic testing of all alternate components prior to the next scheduled performance of the test during the Eleventh Refueling Outage. The Component Cooling Water Pump 3 Refueling Test (DB-SP-03092) will also be revised by the start of the next refueling outage to require testing of CCW Pump 3 as both train 1 and train 2.

Condition 4: On May 14 through May 17, 1997, the Surveillance Tests to measure the response time for affected logic circuitry were performed satisfactorily with no equipment deficiencies. The Surveillance and Periodic Test Schedule was updated on May 19, 1997, to reflect the required testing interval for the logic of the three sensor parameters of SFAS having response time requirements.

Review of safety-related logic circuits as requested by Generic Letter 96-01 is ongoing. This review will be completed prior to startup from the eleventh refueling outage, which is currently scheduled to start in April 1998. Any future deficiencies discovered as a result of this review will be reported in supplements to this LER. Based on the number of events discovered resulting from the Generic Letter 96-01 Review Program, a multi-discipline team is being assembled to identify the overall root cause. This multi-discipline team will evaluate the apparent cause of all events discovered under the Generic Letter 96-01 Review Program in determining the overall root cause. The members of the multi-discipline team will be identified by July 1, 1997. The task plan for the team will also be developed by July 1, 1997. The overall root cause evaluation will be completed thirty days after the completion of the Generic Letter 96-01 Review Program, which is scheduled for the end of the Eleventh Refueling Outage.

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Davis-Besse Unit Number 1	05000346	97	-- 008 --	03	10 OF 10

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

Failure Data:

Previous reports involving safety system logic testing that was inadequate that relate to conditions 1 and 2 described above are LER 91-001, LER 88-020, and LER 85-021. LER 91-001 involved a procedural deficiency that was caused by an inadequate procedure revision. LER 88-020 reported a procedure deficiency that was caused by the field wiring of test switches not being per drawings in SFAS and the Anticipatory Reactor Trip System. LER 85-021 reported that some logic gates in SFAS were not covered by testing, which was caused by the Surveillance Test review process not being technically detailed enough to ensure that all functions of all components were being addressed. Previous supplements to this LER reported conditions 1 and 2 as events involving inadequate safety system logic testing. There have been no LERs within the last three years involving events similar to conditions 3 and 4 described above, where safety system logic testing was not performed within the time frame specified in the Technical Specifications.

NP-33-97-008-3

PCAQRs 97-0364, 97-0430, 97-0624, 97-0640, 97-0659