NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Dresden Nuclear Power Station, Unit 2	05000237	1 OF 7

TITLE (4)
Emergency Core Cooling Systems Suction Strainers Not In Accordance With Design Basis Due To Inadequate Original Design

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	20	96	96	-- 022 --	01	05	15	97	Dresden Unit 3	05000249
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(iii)		73.71(b)
	20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(iv)		73.71(c)
	20.2203(a)(2)(i)		20.2203(a)(4)		50.73(a)(2)(v)		OTHER
	20.2203(a)(2)(ii)		50.36(c)(1)		50.73(a)(2)(vii)		(Specify in Abstract below and in Text, NRC Form 366A)
	20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(viii)(A)		
	20.2203(a)(2)(iv)		50.73(a)(2)(i)		50.73(a)(2)(viii)(B)		
	20.2203(a)(2)(v)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
C. Lashkari - Design Engineer Ext. 2543	(815) 942-2920

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

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

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

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

On December 20, 1996, a 1983 vendor calculation that evaluated the structural adequacy of the Emergency Core Cooling Systems (ECCS) suction strainers was discovered that identified the differential pressure (dP) or head loss across the ECCS suction strainers for both Unit 2 and 3 as 5.8 feet of water. This was not consistent with the Updated Final Safety Analysis Report (UFSAR) and original vendor drawings which have identified the head loss across the strainers as 1 foot of water since the original construction and operation of the plant. The 1 foot pressure drop had been used in the calculations of ECCS pump net positive suction head (NPSH).

This increase in head loss of 4.8 feet requires Dresden Station to take credit for containment overpressure to ensure that the ECCS pumps have adequate net positive suction head (NPSH). As a result, an emergency license amendment request was submitted on January 13, 1997 and approved on January 28, 1997. Another amendment was subsequently issued in February 1997 to remove limitations imposed by the emergency amendment.

The cause of this event is inadequate design of the original torus suction strainers. The safety significance of this event is minimal since, given containment overpressure, the ECCS pumps would have performed their safety function.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 MWt rated core thermal power.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX] and are obtained from IEEE Standard 805-1984, IEEE Recommendation Practice for System Identification in Nuclear Power Plants and Related Facilities.

EVENT IDENTIFICATION:

Emergency Core Cooling System Suction Strainers Not In Accordance With Design Basis Due To Inadequate Original Design

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 2(3) Event Date: 12/20/96 Event Time: 1937

Reactor Mode: N(N) Mode Name: Run(Refuel) Power Level: 100(0)

Reactor Coolant System Pressure: 990(0) psig

B. DESCRIPTION OF EVENT:

This issue is reportable pursuant to 10CFR50.73 (a)(2)(ii)(B), any event or condition that resulted in the nuclear power plant being in a condition that was outside the design basis of the plant.

On December 20, 1996, during a Design Basis Review associated with a proposed modification to the Emergency Core Cooling System (ECCS) suction strainers [BM][BO] that resulted from NRC Bulletin 96-03, a 1983 vendor calculation that calculated the head loss vs. percent plugging of the ECCS suction strainers was discovered that identified the differential pressure (dP) or head loss across the ECCS suction strainers for both Unit 2 and 3 as 5.8 feet of water. This was not consistent with the Updated Final Safety Analysis Report (UFSAR) and original vendor drawings which have identified the head loss across the strainers as 1 foot of water.

Subsequent review of calculations revealed the 1983 calculation was correct and that the incorrect head loss numbers in the UFSAR and drawings had existed since the original construction and operation of the plant.

The NRC was notified by telephone on December 20, 1996 at 20:02. An operability determination was immediately started under a 24 hour limitation. At 20:00 on December 21, 1996 the NRC was notified that the operability determination concluded that the ECCS pumps were operable but degraded.

Historical Data

Construction

The head loss deficiency (5.8 ft. vs 1 ft.) has existed in the original documents since the construction of the plant. General Electric had specified ECCS strainers in the LPCI System Design Specification that would have a pressure drop (across screen and into penetration) of 1 foot of water.

A Sargent & Lundy design drawing was located that contains a note indicating the ECCS suction strainers shall have a maximum head loss across the screen and into the penetrations of 1 foot of water with a 10,000 GPM flow through each. No specification or purchase order for these ECCS suction strainers was located. The as-used construction drawing has a note stating that each strainer shall pass 10,000 GPM with an entrance head loss across the screen of 1 foot of water maximum.

1981-1983

During late 1981, Nutech was working on the Mark 1 containment program and required a structural evaluation of the ECCS strainers for the various combination of loadings. The constructor was contacted for design information for these strainers. No information relevant to the installed strainers at Dresden could be located, even following a search of constructor records by contractor and licensee personnel. Dimensional details and test data for another plant were provided by the constructor, as well as formula and methodology for calculating head loss for any strainer at a given flow rate.

The strainers had been manufactured under subcontract to the constructor. The subcontractor has since gone out of business and no Dresden records are available. In a 1981 meeting with Nutech and ComEd, the constructor had indicated that no file information specific to Dresden was available. Calculations based on flow test data from other projects and Dresden dimensions from field observation resulted in a calculated dP of 5.5 ft.

Nutech created Rev. 0 of Calculation 64.313.3001 documenting head loss at 10,000 GPM flow rate and strainer area blockage from 0 to 50 percent. The calculation indicated head loss of 5.5 ft. of water for 0% plugging. Rev. 1 of this calculation was performed in 1983 to provide structural modification consisting of a stiffener blocking approximately 4 percent of the area. This flow reduction resulted in head loss of 5.8 ft. of water for 10,000 GPM at 0 percent blocking.

These calculations indicate a head loss deficiency which should have been addressed in 1983, but no documentation of how it was addressed could be found in Dresden records. Notes of the meeting between Nutech, ComEd, and the constructor indicate the approach ComEd may have taken on this problem at that time. It was recorded that "If the head loss exceeds 1 foot of water the entire suction piping system will be investigated before the excess pressure loss the strainer is considered a problem." This review may have been performed informally at ComEd or Nutech, and may have indicated no problem with the NPSH for ECCS pumps. No documentation could be found in to support any conclusion.

Nutech Design Specification COM-28-036 dated December, 1981 (File No. 64.313.1111) for ECCS Suction Strainer Structural Modifications was reviewed but no head loss was specified at 10.000 GPM flow rate.

1995 Design Basis Document (DBD) Review and Approval

DBD-DR-0040 Revision A indicates design bases for ECCS suction strainers in paragraph 4.1.1.3 on page 4-9. The DBD indicated in 1995 that "reference for strainer NPSH and vortexing during accident conditions are not available." A review of open items for this section indicates inadequate attention was given to this problem. There was a potential to detect the NPSH problem in this time frame if adequate review had been performed of the DBD and the open items.

Another paragraph in the DBD indicates "The one foot head loss criterion was an initial value chosen such that the design of the overall suction piping system and pump procurement could proceed. The value of the system pressure drop criteria is maintained. The maximum pressure drop of the strainer at rated flow shall be set such that the allowable pressure for the ECCS suction piping is maintained."

The DBD open item 4.0 did not adequately address the comment related to verifying if the calculation information should be captured in the DBD. Though the DBD did reference the 1983 Nutech calculation, no copy was retrieved or evaluated.

1996-1997

The problem with Dresden ECCS strainer head loss and ECCS pump net positive suction head was detected during a planned suction strainer replacement at Quad Cities on December 20, 1996.

New NPSH calculations were performed for Dresden and an emergency license amendment was submitted and was approved on January 28, 1997. The head loss for the ECCS suction strainers has been incorporated in the current design bases.

Conclusions

While the adverse calculation results were known to responsible ComEd personnel, there is no record of any action having been taken. It is possible, but not documented, that review of entire suction side piping as proposed in the meeting notes did not indicate a NPSH problem at Dresden. As detailed in DBD-DR-0040, another possibility is that the one foot head loss criterion was an initial value chosen such that the design of overall suction piping system and pump procurement could proceed. The value of the suction side pressure drop would then be maintained.

The correlation formula used has been confirmed to be mathematically correct by ComEd staff. Similarly, the calculations performed in 1981 and 1983 were reviewed and found to be technically correct. The conclusion from the correlation is that the strainer would have to have a hole area of 2.3 times the existing hole area to have a pressure drop of 1 foot of water at a flow rate of 10,000 GPM.

This increase in head loss of 4.8 feet requires Dresden Station to take credit for containment overpressure to ensure that the ECCS pumps have adequate net positive suction head (NPSH). An operability evaluation was processed which addressed ECCS pump NPSH and the use of containment overpressure. As a result, an emergency license amendment request was submitted on January 13, 1997, and subsequently approved on January 28, 1997.

The emergency license amendment request was based on using 2 psig of containment overpressure during the first ten minutes after a Loss of Coolant Accident (LOCA) and limiting suppression pool temperature and ultimate heat sink temperature to 75 degrees F. The 2 psig of containment overpressure is based on an analysis that is currently in the UFSAR but is not consistent with the Technical Specification Bases.

An additional license amendment request was submitted to restore the ultimate heat sink and suppression pool temperatures to 95 degrees F, utilize additional containment overpressure, and to implement an updated containment analysis. This analysis formally credits post accident containment pressure in Dresden's design basis. The additional license amendment was approved on April 30, 1997.

The NRC Independent Safety Inspection (ISI) that was performed at Dresden in the fall of 1996 identified cases where a design basis parameter was not supported by a calculation. This event is an example of such an instance. Although these other cases were not reportable, Dresden Station is performing a Design Basis Review on 12 systems important to safety as a corrective action.

Current procedures and training provide reasonable confidence that this type of event will not occur. DAP 02-10 provides guidance for processing vendor technical information. NEP-12-02 provides for preparation, review and approval of calculations. Plant Design Changes are processed in accordance with DAP 21-03 and NEP-04-01. The plant design changes are reviewed by an independent reviewer and approved by supervisor per DAP 21-21. An independent Engineering review is performed on selected critical calculations every month. The Engineering Assurance Group (EAG) performs review of Engineering Issues. On Site review is conducted where appropriate by subject matter experts.

There were no structures, systems, or components inoperable at the start of this event that contributed to the event.

C. CAUSE OF EVENT:

The primary root cause for this event is inadequate design of the original torus suction strainers (NRC Cause Code B - Design Deficiency) in that the original specification and testing did not result in adequate suction strainer dP. A contributing cause is personnel error (procedural) (NRC Cause Code A - Personnel Error) in that adequate review of submitted documentation would have prevented this occurrence.

It should be noted that these breakdowns occurred in the period from the original design and construction of the plant through 1983, and changes have been made to prevent recurrence. This organizational weakness is considered historical and not current management practice.

D. SAFETY ANALYSIS:

The safety significance of this event and its impact on safe operation of Core Spray, LPCI and High Pressure Coolant Injection pumps is minimal. Analysis performed to support the amendment submitted in February 1997 shows that sufficient containment overpressure is available to ensure adequate ECCS pump NPSH with the original plant limits on service water and torus water temperature.

If an event had occurred which required ECCS injection, sufficient containment overpressure would have been present to ensure that the ECCS pumps would provide adequate cooling to the core.

E. CORRECTIVE ACTIONS:

1. An emergency license amendment request was submitted (ComEd Letter JSPLTR 97-007) to take credit for containment overpressure as a means of assuring adequate NPSH during an accident and approved on 1/28/97. (Complete)

2. A plant modification is being processed to replace the ECCS suction strainers on both Units 2 and 3 with lower dP strainers. These new strainers are being installed in response to IE Bulletin 96-03. (Mod. No. M12-2(3)-96-006) (2371019600301 & 2371019600302)

3. A license amendment request was submitted to restore the ultimate heat sink and suppression pool temperatures to 95 degrees F, utilize additional containment overpressure, and to implement an updated containment analysis and was approved on April 30, 1997. (Complete)

4. The design basis of systems important to safety will be reconstituted to verify that the design basis of the plant is maintained. (NTS 2371219601608)

5. Additional corrective actions, as a result of design control issues that were identified during the ISI, were communicated in a letter to Mr. A. Bill Beach from Mr. Thomas J. Maiman, dated November 12, 1996.

6. An Engineering Assurance Group (EAG) consisting of senior engineering personnel has been established. The EAG will continue to function to provide oversight of key engineering activities until normal engineering functions have improved to the point where reviews by EAG are no longer necessary. (Complete)

7. A Training Request or Revision (TRR) has been written and will be submitted to the Engineering Training Committee to request additional training during ESPT classes in the area of Engineering Design Specifications, appropriate review of vendor documents, including design calculations, test scope, and procedures to ensure that each item when delivered meets or exceeds the specified performance. Additionally, the proposed training would emphasize the importance of inter- disciplinary review of design specifications in projects where more than one discipline is involved. (237180960220101)

F. PRIOR SIMILAR OCCURRENCES:

A search was conducted for prior similar occurrences of this event relating to the ECCS suction strainers and to the absence of supporting calculations. No previous events were found.

G. COMPONENT FAILURE DATA:

Not Applicable.