Virginia Electric and Power Company
Surry Power Station
P. O. Box 315
Surry, Virginia 23883

February 6, 1991

U. S. Nuclear Regulatory Commission
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Washington, D. C. 20555

Serial No.: 90-727A
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License Nos.: DPR-32
DPR-37

Gentlemen:

Pursuant to Surry Power Station Technical Specifications, Virginia Electric and Power Company hereby submits the following updated Licensee Event Report for Units 1 and 2.

REPORT NUMBER

90-014-01

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be reviewed by the Corporate Management Safety Review Committee.

Very truly yours,

M. R. Kansler
Station Manager

Enclosure

cc: Regional Administrator
Suite 2900
101 Marietta Street, NW
Atlanta, Georgia 30323

15

UPDATE

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, 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)
Surry Power Station, Unit 1	0 5 0 0 0 2 8 0	1 OF 0 7

TITLE (4) Unit 1 and Unit 2 Recirculation Spray Heat Exchangers Declared Inoperable Due to Potentially Inadequate Service Water Flow Caused by Macrofouling

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
1 0	2 3	9 0	9 0	— 0 1 4 —	0 1	0 2	0 6	9 1	Surry Unit 2	0 5 0 0 0 2 8 1
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

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

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[X] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[X] 50.73(a)(2)(vii)	[ ] OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*
[ ] 20.405(a)(1)(iii)	[X] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	
M. R. Kansler, Station Manager	8 0 4	3 5 7 - 3 1 8 4

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES *(If yes, complete EXPECTED SUBMISSION DATE)* [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On October 23, 1990, at 0103 hours, with Unit 1 at refueling shutdown and Unit 2 at 100% power, the Unit 1 and Unit 2 Recirculation Spray Heat Exchangers (RSHXs) were declared inoperable. A special test of Service Water (SW) flow to the Unit 1 "B" and "C" RSHXs had indicated that adequate SW flow may not be available during a design basis accident. This could delay or prevent depressurization of the containment to a subatmospheric condition during a design basis accident. In accordance with Technical Specification 3.0.1, Unit 2 was placed in cold shutdown. The reduced SW flow was caused by macrofouling of the RSHXs from marine growth and fragments of pipe coating. The debris which fouled the RSHXs was present in the SW system at test initiation. Flow reduction occurred in the early stages of the testing and long term macrofouling trends were not observed. The SW supply piping to the Unit 2 RSHXs was cleaned of marine growth and loose pipe coating. Changes in the operation of the Unit 2 SW system will reduce the potential for marine growth to return and to be dislodged upon initiation of SW flow to the RSHXs. Similar measures will be implemented for Unit 1. An enhanced inspection and maintenance program for the SW system is being implemented in response to NRC Generic Letter 89-13. This program will include provisions for biofouling control. A SW pipe repair and recoating project is also being implemented. This report is required by 10CFR50.73(a)(2)(v)(D), 10CFR50.73(a)(2)(vii)(D), and 10CFR50.73(a)(2)(i)(A).

1.0 DESCRIPTION OF THE EVENT

On October 23, 1990 at 0103 hours, with Unit 1 in Refueling Shutdown and Unit 2 at 100% power, the Unit 1 and Unit 2 Recirculation Spray Heat Exchangers (RSHXs) (EIIS-BE,HX) were declared inoperable based on the results of a special test performed on Unit 1. The testing was conducted for the purpose of confirming Service Water (SW) (EIIS-BI) flow rate and pressure drop through the RSHXs as predicted by design basis calculations. The testing, controlled by Special Test Procedure 1-ST-290, consisted of establishing SW flow to the Unit 1 "B" and "C" RSHXs and measuring SW flow, inlet static pressure, and differential pressure across each heat exchanger.

The test was initially performed October 14-16, 1990. The system was filled and vented up to the RSHX SW discharge isolation valves at the beginning of the test. Filling and venting the system were intended to ensure maximum accuracy from the temporary test instrumentation in use. At test initiation, SW flows were 8900 gpm and 9200 gpm for the "B" and "C" RSHXs, respectively. These initial flows were consistent with expected values; however, flows decreased for several hours and stabilized at approximately 5500 gpm and 6300 gpm.

Additional testing was performed October 22-23, 1990 with the RSHXs and inlet piping in their design basis dry layup condition at the beginning of the test. At test initiation, flow readings were erratic due to air migration into the instrument lines. After resolution of the instrument problems, stable flow readings of approximately 4300 gpm and 2200 gpm were obtained for the "B" and "C" RSHXs, respectively.

Based on the test results, the Unit 1 and Unit 2 RSHXs were declared inoperable at 0103 hours on October 23, 1990, since it was uncertain whether the design SW flow of 6000 gpm per heat exchanger could be attained during design basis accident conditions. Technical Specification 3.4 requires that the RS system be operable whenever Reactor Coolant System temperature and pressure exceed 350 degrees Fahrenheit and 450 psig, respectively. With all of the Unit 2 RSHXs considered inoperable, Technical Specification 3.0.1 requires that the unit be placed in hot shutdown within six hours and in cold shutdown within the following 30 hours (until the unit is in a condition in which Specification 3.4 is not applicable). At 0120 hours, a Unit 2 power reduction was initiated and a Notification of Unusual Event (NOUE) was declared due to the mode reduction required by Technical Specifications. Notifications to the appropriate state and local authorities were made at 0130 hours and an emergency notification to the Nuclear Regulatory Commission was made at 0148 hours in accordance with 10CFR50.72(a)(l)(i). Unit 2 achieved hot shutdown at 0610 hours on October 23, 1990, and cold shutdown at 0830 hours on October 24, 1990, terminating the NOUE.

This report is required by 10CFR50.73(a)(2)(v)(D) since a condition existed which could have prevented fulfillment of the safety function of a system needed to mitigate the consequences of an accident.

This report is also required by 10CFR50.73(a)(2)(vii)(D) since a single condition caused two independent trains to become inoperable in a single system designed to mitigate the consequences of an accident.

This report is also required by 10CFR50.73(a)(2)(i)(A) since a shutdown required by Technical Specifications was completed.

2.0 SAFETY CONSEQUENCES AND IMPLICATIONS

The Recirculation Spray (RS) system, in conjunction with the Containment Spray (EIIS-BE) system, is designed to cool and depressurize the containment to subatmospheric pressure within 60 minutes following a design basis accident, and to maintain the subatmospheric pressure for 30 days. The RS system consists of two 100% capacity trains, each of which has two parallel flow paths. Each flow path is from the containment sump to a RS pump then through the shell side of a RSHX into a discharge spray header in the upper portion of the containment. The SW system provides a heat sink for removal of heat from the containment sump. SW flow to the tube side of the RSHXs is by gravity flow from the station intake canal. The SW flow path to each train of RS is from a 96 inch diameter Circulating Water (CW) (EIIS-KE) tunnel to a 48 inch diameter SW header and into two 30 inch supply lines to the RSHXs. During normal operation, the 96 inch CW tunnel, the 48 inch SW header, and a short length of the 30 inch lines (to the 103/203 valves) are flooded. The remainder of the SW inlet piping, the RSHXs, and a portion of the discharge piping are maintained in dry layup.

Reduced SW flow to the RSHXs could delay or prevent the depressurization of containment to a subatmospheric condition in the unlikely event of a design basis accident. This could result in increased containment leakage and radioactivity release. These potential consequences would be limited, however, by several factors:

1. Each of the four RSHXs has the capability to remove 50% of the design basis heat load. If all four of the RSHXs were available, they could each be operating at half of their design basis efficiency and containment heat removal requirements would still be met.

2. Service water is assumed to be at a temperature of 92 degrees Fahrenheit in design basis calculations, while it is typically at a lower temperature.

3. It was found, during the flow test, that isolating then re-establishing SW flow to a RSHX would cause a substantial recovery of SW flow. This is discussed further in Paragraph 3.0.

4. Containment leakage in a design basis accident is assumed to occur at a rate of 0.1% per day (La) until containment pressure is reduced to subatmospheric.Technical Specifications limit integrated containment leakage to 0.75 La and actual leakage as measured in surveillance tests is generally substantially below the Technical Specification limit.

Due to these mitigating factors, it is considered unlikely that the observed SW flow rates would have increased the consequences of a design basis accident.

Additional evaluations of the safety significance were completed in December, 1990. These analyses provide a more rigorous basis for evaluating the safety consequences of the event. The analyses evaluated two accident scenarios with the RS SW system in the condition revealed by the SW flow test of October 22-23, 1990. One scenario (Case 1) assumed minimum safeguards. This scenario includes a large break LOCA coincident with loss of off site power and failure of one emergency diesel generator eliminating one full train of safeguards equipment on the accident unit. This event is extremely unlikely having an estimated probability of 1.7E-8/yr. The second scenario (Case 2) assumed a LOCA with no loss of off site power and both trains of safeguards equipment operable. This event is also unlikely (estimated probability of 1.0 E-4/yr). For both cases, blockage of the RSHX tubes, as indicated by the flow test results, was assumed and certain other parameters were assumed to be at realistic values in line with operational data.

Case 1 results indicate 10CFR100 limits for off site doses are not exceeded. The control room thyroid dose is in excess of the General Design Criterion (GDC) 19 allowable limits. However, these results are based on conservative Standard Review Plan (SRP) assumptions which assume a fuel overtemperature event. However, since the evaluations indicate that flow is maintained from one low head safety injection pump, a separate dose calculation was performed assuming no fuel overtemperature event and the associated fuel failures. Using this more realistic source term, both the off site and control room doses are lower and below the regulatory limits. The case 1 analysis indicates that the containment does not stay subatmospheric. However, the maximum containment pressure is not increased so the probability of containment failure is not increased.

For the Case 2 assumptions, the containment depressurizes within the first hour of an accident and remains subatmospheric. The doses were within the 10CFR100(off site) and GDC 19 (control room) limits.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Surry Power Station, Unit 1	0 5 0 0 0 2 8 0	9 0	— 0 1 4	— 0 1	0 5 OF 0 7

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

Based on the information presented herein including both cases of the accident analysis, the potential consequences to the public health and safety were not increased.

3.0 CAUSE

The reduced SW flow rates were caused by macrofouling of the RSHXs by small pieces of coating which detached from the interior of the SW supply piping and by marine growth dislodged from SW supply piping when flow was initiated.

Inspection of the RSHXs following the flow tests revealed an accumulation of detached coating pieces, hydroids, and shellfish in the end bells where SW enters. Inspection of the SW supply piping indicated that the primary source of the detached coating was the vertical SW pipe segments at the inlets to the RSHXs. This piping, which is normally in dry layup, experienced corrosion in areas where its protective coating degraded, permitting pieces of the coating to detach from the pipe wall. Post-test piping inspection also indicated that the primary source of the hydroids was the 48 inch SW supply header, while the shellfish originated from the normally flooded portion of the 30 inch SW supply lines. It is believed that the debris which fouled the RSHXs was present in the SW supply piping at the beginning of the testing, since flow reduction occurred in the early stages of the tests and no long-term macrofouling trend was observed.

Macrofouling was demonstrated to be the sole cause of the reduced SW flows. Venting of the RSHXs following flow testing released very little air, eliminating air binding as a cause of the reduced flow. Isolating and then re-establishing SW flow to the RSHXs during the testing caused significant flow recovery, as a result of debris falling away from the tubesheet when differential pressure was lost.

Macrofouling was observed to be more severe in the second test due to the higher initial flow velocity into the dry inlet piping, which caused a greater amount of marine growth to be swept from the normally wetted piping. This was substantiated by post-test piping inspection which revealed that the most pronounced "cleaning" of marine growth from the piping took place in the vicinity of the 103 valves.

4.0 IMMEDIATE CORRECTIVE ACTION(S)

Unit 2 was placed in cold shutdown based on the results of the Unit 1 testing. Unit 1 was already in refueling shutdown.

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

5.0 ADDITIONAL CORRECTIVE ACTION(S)

The Unit 2 SW supply piping to the RSHXs was inspected and cleaned of marine growth and loose coating material.

Test results indicated that it was desirable to operate with the SW inlet piping to the RSHXs partially filled with water. This would lessen the initial SW flow velocity and reduce the likelihood that marine growth would be dislodged from the normally flooded supply piping.

Following cleaning of the SW supply piping, an additional flow test was performed on the Unit 1 "B" and "C" RSHXs with the system in this partially filled configuration. At test initiation, flows of approximately 12,000 gpm and 11,500 gpm were measured for the "B" and "C" RSHXs, respectively. Flows decreased to 10,000 gpm and 9,500 gpm as expected when valve manipulations in the CW system were made and flows remained essentially constant for the duration of the test. There was no indication of significant macrofouling during the 24 hour duration of the test. A very small amount of marine life was found in the RSHXs in a post-test inspection. Based on the successful results of this test, Unit 2 will be operated in the configuration described above.

To reduce the potential for the return of hydroids, flow through the 48 inch SW supply headers will be alternately reduced to near stagnation, limiting the supply of oxygen and nutrients which are necessary for growth of the hydroid species found in the SW piping. This will be accomplished by alternating the SW supply to the Bearing Cooling heat exchangers (EIIS-KB,HX) from one 48 inch SW header to the other approximately once per week. Reduced SW temperature for the remainder of the Unit 2 operating cycle will also serve to retard hydroid growth. A safety analysis was prepared to support Unit 2 operation through the end of Cycle 10.

The measures described above will also be implemented for Unit 1. A safety analysis has been performed to support Unit 1 operation through June 1, 1991. The analysis takes into account the effect of reduced service water temperature in retarding hydroid growth.

6.0 ACTIONS TO PREVENT RECURRENCE

In response to Generic Letter 89-13, an enhanced program of SW system inspection and maintenance is being implemented. This program is intended to ensure that corrosion, erosion, protective coating failure, silting, and biofouling will not degrade the performance of safety-related systems supplied by SW. This program includes an evaluation of chemical treatment techniques to retard biological growth in the SW supply piping. Initial activities are being implemented during the

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Surry Power Station, Unit 1	0 5 0 0 0 2 8 0	9 0	— 0 1 4 —	0 1	0 7 OF 0 7

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

current Unit 1 refueling outage and will be implemented for Unit 2 during its next scheduled refueling outage.

In addition to the Generic Letter 89-13 activities, a SW pipe repair and recoating project is being implemented. This project includes repair of corrosion damage and recoating with a more durable material. In order to support warm weather operation, an interim program to monitor and retard marine growth in the 48 inch service water supply piping to the RSHXs is being developed. The elements of this program as currently planned include chemical treatment, and monitoring of service water parameters to determine propensity for hydroid growth. Additional studies of the SW ecosystem and evaluation of various methods to reduce macrofouling and biological growth are underway.

7.0 SIMILAR EVENTS

LER 280/88-031: It was determined that an adequate supply of SW to the RSHXs may not be available in the event of a Loss of Coolant Accident with a Loss of Off Site Power. This condition was the result of several design deficiencies which could have resulted in inadequate intake canal inventory, given certain single failures.

8.0 MANUFACTURER/MODEL NUMBER

None.