

ACCELERATED DOCUMENT DISTRIBUTION SYSTEM

REGULAR INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9304060099 DOC. DATE: 93/03/31 NOTARIZED: NO DOCKET #
 FACIL: 50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
 AUTH. NAME AUTHOR AFFILIATION
 HURCHALLA, J.A. Florida Power & Light Co.
 SAGER, D.A. Florida Power & Light Co.
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-004-00: on 930302, personnel discovered water dripping onto floor in containment near pressurizer, due to PWSCC. Future visual insps of selected instrument nozzles will be performed. W/930331 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED: LTR 1 ENCL 1 SIZE: S
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	ENCL
	PD2-2 LA	1	1	PD2-2 PD	1	1
	NORRIS, J	1	1			
INTERNAL:	ACNW	2	2	ACRS	2	2
	AEOD/DOA	1	1	AEOD/DSP/TPAB	1	1
	AEOD/ROAB/DSP	2	2	NRR/DE/EELB	1	1
	NRR/DE/EMEB	1	1	NRR/DORS/OEAB	1	1
	NRR/DRCH/HHFBHE	1	1	NRR/DRCH/HICB	1	1
	NRR/DRCH/HOLB	1	1	NRR/DRIL/RPEB	1	1
	NRR/DRSS/PRPB	2	2	NRR/DSSA/SPLB	1	1
	NRR/DSSA/SRXB	1	1	REG-FILE 02	1	1
	RES/DSIR/EIB	1	1	RGN2 FILE 01	1	1
EXTERNAL:	EG&G BRYCE, J.H	2	2	L ST LOBBY WARD	1	1
	NRC PDR.	1	1	NSIC MURPHY, G.A	1	1
	NSIC POORE, W.	1	1	NUDOCS FULL TXT	1	1

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK,
 ROOM P1-37 (EXT. 504-2065) TO ELIMINATE YOUR NAME FROM DISTRIBUTION
 LISTS FOR DOCUMENTS YOU DON'T NEED!

A04

FULL TEXT CONVERSION REQUIRED
 TOTAL NUMBER OF COPIES REQUIRED: LTTR 32 ENCL 32



March 31, 1993

L-93-089
10 CFR 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Event: 93-004
Date of Event: March 2, 1993
Pressurizer Instrument Nozzle Leakage
Due to Primary Water Stress Corrosion Cracking

The attached Licensee Event Report is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Very truly yours,

D. A. Sager
Vice President
St. Lucie Plant

DAS/JWH/kw

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, USNRC Region II
Senior Resident Inspector, USNRC, St. Lucie Plant

DAS/PSL #892-93

9304060099 930331
PDR ADOCK 05000389
S PDR

050077 company

LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.8 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-532), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20546, AND TO THE PAPERWORK REDUCTION PROJECT (0150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) St. Lucie Unit 2	DOCKET NUMBER (2) 05101010389	PAGE (3) 1 OF 04
--	---	----------------------------

TITLE (4) **Pressurizer Instrument Nozzle Leakage Due to Primary Water Stress Corrosion Cracking**

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)			
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)		
03	02	93	93	004	00	03	31	93	N/A		0151010101		
										N/A		0151010101	

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR : (Check one or more of the following) (11)									
POWER LEVEL (10)	000	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)						
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)						
		20.405(a)(1)(ii)	50.36(c)(2)	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 James A. Hurchalla, Shift Technical Advisor							TELEPHONE NUMBER		
							AREA CODE		
							407465-3550		

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
B	A B	N Z L	C 4 9 10						

SUPPLEMENTAL REPORT EXPECTED (14)						EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO				

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

On March 2, 1993 utility personnel discovered water dripping onto the floor in containment near the pressurizer. Operations maintained the plant in Mode 5 with the pressurizer solid to determine the leakage source. A visual inspection revealed the four upper instrument nozzles were leaking at the entry fitting to the pressurizer. The scope of the investigation was expanded to include the lower instrument water space nozzles on the pressurizer as well as the Reactor Coolant System (RCS) hot leg nozzles as they were all part of an earlier replacement of the same heat number. No other instrument nozzles showed any indication of leakage. On March 4, 1993, following drain down of the pressurizer, work was begun to inspect the upper steam space instrument nozzles and pressure boundary welds in conjunction with the vendor, Combustion Engineering. Liquid Penetrant and Eddy Current Tests were performed on the nozzles and weld areas which revealed axial cracking in the four steam space nozzles extending into the surrounding weld area.

The root cause of leakage escaping from through wall cracks in the affected nozzles was diagnosed as Primary Water Stress Corrosion Cracking (PWSCC). The axial orientation of the cracks and their origination in the nozzle material is consistent with previous industry experience with Inconel 600 instrument nozzles. Cracking of this nature is not considered to present a significant safety risk due to slow rates of propagation and minimal expected leak rate.

The corrective actions were: 1) Replacement of the cracked nozzles with a material more resistant to PWSCC. 2) Performed a visual inspection of nozzles of the same heat number in the RCS. 3) Nuclear Engineering evaluated the life expectancy of the remaining nozzles to ensure adequacy for continued operation. 4) Future visual inspections of selected instrument nozzles will be performed.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-537), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20543, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0184), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) St. Lucie Unit 2	DOCKET NUMBER (2) 05000389	LER NUMBER (6)				PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		93	004	00	02	OF	04

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

DESCRIPTION OF THE EVENT

On March 2, 1993 Unit 2 was in Mode 5 implementing the "RCS Fill and Vent Procedure" OP 2-0120020 with the Reactor Coolant System (RCS)(EIS: AB) pressurizer (EIS: AB) at 100% level and 310 psia. An FPL utility man discovered water dripping onto the floor in containment near the pressurizer. This information was immediately communicated to the control room. The Outage Shift Directors and Operations decided to maintain the plant in Mode 5 with the pressurizer solid to determine the leakage source. The insulation around the pressurizer was removed and a team consisting of Quality Control and Engineering was assembled to inspect the upper steam space instrument nozzles (EIS: AB) which were suspected to be the source of the leakage. The inspection revealed each of four upper steam space instrument nozzles were leaking at their entry fittings to the pressurizer. The scope of the investigation was expanded to include the lower instrument water space nozzles on the pressurizer and the RCS hot leg instrument nozzles as they were of the same type, material, and heat number. No other nozzles showed indications of leakage. The steam space nozzles were installed in 1987 and the other nozzles of the same heat number were installed in 1989 as replacements in response to a similar event at San Onofre in 1986.

On March 4, 1993, following drain down of the pressurizer, work was begun to inspect the four upper instrument nozzles on the pressurizer and their pressure boundary welds in conjunction with the vendor, Combustion Engineering (CE). The pressurizer vessel steam space consists of the carbon steel outer vessel and a 304 stainless steel inner clad. The pressurizer instrument nozzles are Inconel 600 with a stainless steel safe end. The Inconel end of the nozzle is welded on the inside of the pressurizer to a weld buttering of Inconel over the stainless steel clad for compatibility. Liquid Penetrant and Eddy Current Tests were performed on the nozzles and weld areas which revealed axial cracking in the four nozzles. The nozzle which had originally been identified as leaking was found to have three cracks. Two nozzles had two cracks and one nozzle had one crack. The cracks were approximately 3/4 of an inch length in the axial direction of the nozzle material and extended outward into the adjacent weld approximately 1/2 to 3/4 of an inch. No evidence of circumferential cracking was found.

CAUSE OF THE EVENT

The root cause of the pressurizer instrument nozzle cracking was diagnosed as Primary Water Stress Corrosion Cracking (PWSCC). Inconel 600 nozzles have proven to be susceptible to this as evidenced by similar industry events at San Onofre and Calvert Cliffs. This is particularly true for nozzles located in the steam space of the pressurizer as it is a more aggressive environment. The axial orientation of the cracking and its originating in the nozzle material are consistent with PWSCC.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION
REQUEST: 50 2 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS
AND REPORTS MANAGEMENT BRANCH (P-302), U.S. NUCLEAR REGULATORY COMMISSION,
WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE
OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) St. Lucie Unit 2	DOCKET NUMBER (2) 05000389	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		93	004	00	03	OF	04

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

ANALYSIS OF THE EVENT

The leakage at the instrument nozzle was on the order of drops per minute. The leakage path was through the crack in the nozzle material which is considered to be part of the Reactor Coolant System (RCS) pressure boundary. As described in the Technical Specifications (TS) 3.4.6.2 this would be considered "pressure boundary" leakage. Due to the slow rate of propagation for this type of cracking a conservative assumption would be that leakage existed during the most recent operations at 100% power. Therefore, this event is reportable under 10 CFR 50.73.a.2.i.B as operation prohibited by plant technical specifications. As is required in this mode of operation a containment walkdown per AP 0010728 "Post Outage Review" which addresses RCS leakage is performed prior to Mode 4. Quality Control personnel perform visual inspections as required by OP 2-0030120 "Prestart Checkoff List" prior to entering Mode 2. These procedures provide a high degree of assurance for RCS integrity prior to start up of the unit.

The instruments associated with these instrument nozzles include the four Reactor Protection System (RPS) RCS pressure channels. Engineered Safety Features RCS pressure instrumentation and various control grade instrumentation are also located off these taps. However, the quantity of the leakage was not significant enough to effect the operability of any of the associated instruments.

The Combustion Engineering Owners Group (CEOG) has addressed this issue in an evaluation in 1991 (CEOG Task No. 634). This analysis concludes that axial through wall nozzle cracks will not result in unstable rupture and will be confined to slowly increasing leak rates in the fraction of a gallon per minute range. A gradually increasing leak rate would be detected by routine RCS inventory balance or by the various RCS leak detection systems. Circumferential cracking would be of greater concern as it could lead to a guillotine break or nozzle ejection. However, industry experience for Primary Water Stress Corrosion Cracking of Inconel 600 instrument nozzles has shown cracking to be only axial in nature. Furthermore, per the CEOG analysis, the hoop stresses induced in welding the nozzles to the pressurizer were analyzed to result in axial and not circumferential cracking. No indications of circumferential cracking were found during inspections of the pressurizer steam space nozzles.

Therefore, the health and safety of the public were not at risk during this event.

CORRECTIVE ACTIONS

- 1) The leaking pressurizer steam space nozzles fabricated with Inconel 600 have been removed and were replaced with nozzles of Inconel 690 which are more resistant to Primary Water Stress Corrosion Cracking.
- 2) The other Instrument nozzles on the RCS of the same material and heat number were visually inspected by Quality Control and showed no indications of leakage.

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION
REQUEST: 50.2 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS
AND REPORTS MANAGEMENT BRANCH (P-335), U.S. NUCLEAR REGULATORY COMMISSION,
WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE
OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) St. Lucie Unit 2	DOCKET NUMBER (2) 05000389	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		93	004	00	04	OF	04

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

CORRECTIVE ACTIONS

- 3) FPL Nuclear Engineering validated the Combustion Engineering Owners Group analysis (CEOG Task No. 634) for specific applicability at St. Lucie.
- 4) The plant will continue to monitor selected instrument nozzle integrity by inspections during subsequent refueling outages on both Unit 1 and Unit 2.
- 5) A description of this event will be shared with the industry by an entry into the INPO Nuclear Network.

ADDITIONAL INFORMATION

Failed Components

Component: Instrument Nozzles on the Reactor Coolant System
 Location: Upper Pressurizer Steam Space
 Material Type: SB 166 Alloy 600
 Material Supplier: Coulter Steel
 Code No.: J-8611-1
 Heat No.: 41501
 Yield Strength: 42.5 KSI

Previous Similar Events

During replacement of the four pressurizer steam space instrument nozzles on Unit 2 in 1987 it was determined that two nozzles had cracks but there was no evidence of leakage.