NRC FORM 366 (6-89) — U.S. NUCLEAR REGULATORY COMMISSION

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

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): CRYSTAL RIVER UNIT 3 (CR-3)

DOCKET NUMBER (2): 0 5 0 0 0 3 0 2

PAGE (3): 1 OF 0 4

TITLE (4): Evaluation Oversight Causes Wej-It Pipe Supports Factor of Safety to Be Less Than NRC Requirements

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)
									N/A	0 5 0 0 0
0 5	0 1	9 2	9 2	— 0 0 6 —	0 1	0 4	1 4	9 3	N/A	0 5 0 0 0

OPERATING MODE (9): 5

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)	X	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)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)	X	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)
W. A. Stephenson, Nuclear Safety Supervisor	9 0 4 7 9 5 - 6 4 8 6

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
X	J K	0 0 6 5	W 2 9 0	YES					

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 fifteen single-space typewritten lines) (16)

On May 1, 1992 at 1720, Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN). CR-3 reported to the Nuclear Regulatory Commission (NRC) that four safety-related pipe supports did not meet the minimum FACTOR OF SAFETY (FS) as specified in NRC IE Bulletin 79-02, Revision 2. The root cause of the problem was a design oversight by the architect engineering firm (AE) in 1984 while evaluating supports using Wej-it anchor bolts. These supports were being evaluated for reduced anchor bolt capacity identified by the manufacturer. The AE failed to consider that the FS for certain piping supports had already been impacted by prying effects as presented in Bulletin 79-02, Rev. 2. Piping supports with Technical Specification operability requirements and a FS of less than or equal to two were modified to bring them into compliance prior to plant startup from Refuel 8 in July 1992. Modification of piping supports with a FS greater than two but less than four will be completed within ninety days following the completion of the current mid-cycle outage. The CR-3 Pipe Support Design Guide developed in late 1989 will prevent recurrence by providing detailed guidance for pipe support design, including prying effects.

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EVENT DESCRIPTION:

On May 1, 1992 at 1720, Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN) in preparation for refueling. Florida Power Corporation (FPC) reported to the Nuclear Regulatory Commission (NRC) that the "A" Decay Heat Pump suction line support [BP,SPT], "B" Makeup Pump suction line support [BQ,SPT], Evaporator Discharge line support [WD,SPT], and "C" Reactor Building Fan support [BK,SPT] did not meet the minimum FACTOR OF SAFETY (FS) as specified in NRC IE Bulletin 79-02, Revision 2.

The following are events leading to the discovery and reporting of this event. In 1979, as part of NRC Bulletin 79-02, Rev. 2, FPC committed to review Seismic Category 1 (S-1) pipe supports which had a FS of less than eight. No evaluation was performed for any pipe support with a FS greater than eight since worst case prying would result in no more than a 50% reduction in a FS which would still meet the minimum acceptable limit of four as required by NRC Bulletin 79-02, Rev 2. However, the actual recorded calculated FS of the individual supports was not formally reduced nor recorded in any engineering documentation.

In 1984, FPC was notified by the manufacturer of Wej-it anchor bolts that the company could not guarantee the tensile strength of its Wej-it bolts as delineated in their product catalog information. The Expansion Anchor Review Program was initiated to determine the impact of this change on the installed piping supports. Those supports installed using Wej-it bolts and which had a FS less than eight were re-evaluated. The re-evaluation subsequently reduced anchor bolt allowable stress by 50%. This is equivalent to reducing the FS by 50%. Since the FS had been previously reduced by 50% for prying effects, the subsequent 50% reduction resulted in a FS of 25% of the originally calculated FS. However, because the original 50% reduction had not been documented, it was not recognized that the FS of these supports had been reduced 75%. There were 331 supports involved.

In 1991, the Architect Engineering (AE) firm Gilbert/Commonwealth Incorporated (G/CI) was contracted by FPC to perform an analysis on a section of piping for a future modification. G/CI engineers discovered the Expansion Anchor Review Program had not addressed the prying effect on 331 safety-related supports as required by NRC Bulletin 79-02, Rev 2. FPC was notified by G/CI that some anchors may be outside NRC acceptance criteria. G/CI was retained to calculate and evaluate prying effect on piping supports installed with Wej-it expansion bolts. The following systems are affected by the reevaluation:

Low Pressure Injection	[BP]	Building Spray	[BE]
High Pressure Injection	[BQ]	Nuclear Service Water	[CC]
DH Closed Cycle Cooling	[CC]	Spent Fuel Cooling	[DA]
Emergency Diesel Fuel Oil	[DC]	Emergency Feedwater	[BA]

Feedwater	[JB]	Main Steam	[SB]
Leak Rate	[IJ]	Core Flood	[BP]
Reactor Coolant System	[AB]	Floor Drains	[WK]

On May 1, 1992, G/CI notified FPC that the FS calculations for the four pipe supports identified above were below the minimum acceptance value as specified in NRC Bulletin 79-02, Rev 2. FPC declared the "A" Decay Heat (DH) train inoperable and commenced immediate repair to restore the "A" DH pipe support to acceptable standards. The "B" DH train was providing reactor cooling. The reactor coolant system was filled and a steam generator was available as a back-up source of core cooling. The "B" DH train similar support was quickly evaluated to determine if both DH trains were affected. The "B" train supports meet the minimum FS requirements. The remaining three systems with supports having inadequate factors of safety are not required for MODES 5 or 6. G/CI also notified FPC that six other support calculations were less than the NRC Bulletin 79-02, Rev. 2 acceptance value of four but greater than the minimum FS of two.

CAUSE:

The root cause of the problem was a design oversight by the AE firm, G/CI. When G/CI performed the 1984 Expansion Anchor Review they failed to consider that the FS for certain piping supports had already been impacted by prying effects as presented in NRC Bulletin 79-02, Rev 2.

EVENT ANALYSIS:

The safety function of the affected supports is to ensure the integrity of the safety-related piping systems which they support. The pipe supports must withstand the dead weight, seismic, and thermal load without failure. Pipe supports are structural items and, therefore, are not susceptible to degradation or inoperability due to humidity and temperature.

Based on the prying factors provided by G/CI, the minimum estimated possible FS was 1.68 for angle type supports and the FS was 2 for baseplate type supports at the outset of the re-evaluation. As such, it was determined that the affected pipe supports would have maintained their structural integrity and performed their required safety function. The oversight had no effect on the health and safety of the public.

CORRECTIVE ACTION:

On May 1, 1992, G/CI reported that four pipe support calculations failed to meet the minimum acceptable FS. Based on actual plant conditions, FPC declared one applicable support inoperable, resulting in the "A" DH train also being declared inoperable. Within 72 hours, the DH support was repaired and the system was returned to service. The remaining three supports and their systems were not required in MODES 5 and 6. These supports were repaired prior to entering MODE 3.

By Refuel 8 in 1992, the 331 supports which were omitted from the original Wej-it review program were conservatively evaluated using manual calculations. Those piping supports with Technical Specification operability requirements, whose calculations resulted in a FS of two or less, were modified to bring them into compliance with NRC Bulletin 79-02, Rev. 2 prior to restart from REFUEL 8 in July 1992. Due to the large number of supports to be reviewed and the short schedule, conservative prying factors and analytical techniques were used in the support evaluations.

Following restart from REFUEL 8, before undertaking a wholesale modification effort for supports with factors of safety between 2.0 and 4.0, FPC chose to re-analyze these supports using more accurate finite element techniques and a computer code (PRYTEN) to remove excessive conservatism from the previously assumed prying factors. This enabled FPC to analytically qualify numerous supports. Seventeen supports were determined to have factors of safety between 2.0 and 4.0 and would require modification. After the finite element work was complete in September 1992, the design work was begun on these 17 supports. Material availability, design problems and rescheduling the start of the mid-cycle outage from April to March 4, 1993 precluded all but five of the supports from being worked in this outage. The remaining 12 supports will be worked following the outage and should be completed within ninety days following completion of the current mid-cycle outage.

The likelihood of this problem recurring has been reduced by the December 1, 1989 creation of the CR-3 Pipe Support Design Guide (SP-88-019). This document provides detailed guidance and a consistent uniform approach for pipe support design, including prying effects.

PREVIOUS EVENTS:

There have been approximately seven LERs since 1980 which addressed problems associated with supports or hangers.