Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

June 17,1997
3F0697-21

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Subject: Reactor Coolant System Attachment Piping Fatigue Analysis, TAC No. M95347

References: A. NRC to FPC letter, 3N0497-09, dated April 7, 1997

B. FPC to NRC letter, dated January 25, 1971, FSAR Amendment 11

Dear Sir:

Florida Power Corporation (FPC) is submitting this letter in response to Reference A, which requested information regarding the Reactor Coolant System (RCS) piping analysis and its compliance with the Crystal River Unit 3 (CR-3) licensing basis requirement as described in the CR-3 Final Safety Analysis Report (FSAR). NRC has questioned whether a fatigue analysis as required by USAS B31.7, Code for Pressure Piping, Nuclear Power Piping, dated February, 1968, has been performed for "...the segment of RCS attachment piping from the main RCS pipe up to and including the second of two valves that are normally closed (i.e., Class 1 boundary)." NRC has also requested that FPC confirm NRC's understanding of the licensing basis for RCS attachment piping. Reference A states, "...certain RCS attachment piping at Crystal River 3, may not have been analyzed for fatigue loads and, accordingly, may not be consistent with your licensing basis as described below.'

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'FSAR paragraph 4.1.3.2 states that the design, fabrication, inspection, and testing of the RCS piping (including the attachment piping indicated in FSAR Table 4-6) are in accordance with USAS B31.7, Code for Pressure Piping, Nuclear Power Piping, dated February, 1968 (B31.7 Code). Per 10 CFR 50.2 definition of reactor coolant pressure boundary, FSAR Figure 4-1

identifies all RCS piping up to and including the second of two valves that are normally closed, as Class 1 components. 10 CFR 50.55a(c)(1) and the B31.7 Code require rigorous fatigue analysis of Class 1 components."

FPC has reviewed the design and licensing basis requirements as stated in the FSAR and has determined that the design and licensing basis for the RCS attachment piping (segment from the main RCS pipe up to and including the second of two valves that are normally closed) is defined in FSAR Sections 1.3.2.12 and 5.4.4 which state;

- "Power piping complies with B31.1.0-1967. "Nuclear" piping other than RCS piping is designed and field hydro-tested in accordance with B31.1.0-1967; but is fabricated, shop-tested, erected, and inspected to B31.7-1969 including Code Case B31-83 (October 1970) by N1, N2, N3 classification. "Nuclear" piping as described above is used in systems that normally contain a radioactive substance." (FSAR Section 1.3.2.12)

  FPC Notes that FSAR Section 1.3.2.12 goes on to describe the code sections which apply for earthquake, vibration, braces, additive stresses, and other stress analyses required by B31.1.0.

- "Nuclear class piping systems have been fabricated, erected, shop-tested, and inspected with the intent of satisfying the applicable sections of the Code for Nuclear Power Piping USAS (ANSI) B31.7. The basic guideline for the design and field hydro-testing of piping has been the Code for Pressure Piping USAS (ANSI) B31.1.0-1967 and those portions of Code Case N7. Pertinent sections from this Code apply to Class I piping described hereafter:" (FSAR Section 5.4.4)

The design and licensing basis for the RCS piping is described in FSAR Section 4.1.3.2 and Table 4-2 which requires the RCS piping to be designed, fabricated, erected, hydro-tested and inspected in accordance with USAS B31.7-1968.

FPC has confirmed that the design and licensing basis for the RCS and the RCS attachment piping are as described in the text and tables of the FSAR discussed above. However, FPC has noted during review that the placement of design and inspection code class break symbols as shown on FSAR Figure 4-1, if not read in conjunction with the text of the FSAR, could indicate that the RCS attachment piping is B31.7 out to the second normally closed isolation valve. This is inconsistent with the FSAR text (Sections 4.1.3.2, 1.3.2.12 and 5.4.4) and tables (4-2 and 4-6). While Figure 4-1 is accurate with respect to the fabrication, shop-testing, erection and inspection of the RCS attachment piping, it does not accurately represent design and hydro-testing code classification of this piping.

The foregoing responds to the issues raised in NRC's letter and provides an adequate basis for resolution of this matter for the restart of CR-3. However, FPC recognizes the need to improve the design analysis of the RCS attachment piping in order to increase assurance that these sections of piping will perform adequately for the remainder of the CR-3 lifetime. Additionally, fatigue analyses would be necessary to meet potential requirements associated with a possible future license renewal. Therefore, FPC will develop a program, plan and schedule for performing necessary Class 1 fatigue analyses by September 30, 1997. FPC's plan will build on industry experience and an assessment of CR-3 piping configurations. This plan will also address the resolution of inconsistencies identified within the information provided on FSAR Figure 4-1. This analytical effort will not be completed prior to restart of CR-3 because a complete full Class 1 fatigue analysis will require significant commitment of FPC time and resources. Other utilities in the B&W Owner's Group are performing these analyses for reasons similar to FPC's and FPC intends to build on the experience gained from these analyses in the development of its plan and schedule.

As noted above the analysis effort will not be completed prior to the restart of CR-3, since the design and licensing basis has been met. Attachment 1 provides an expanded discussion of design and licensing basis and restart.

A one week extension of time, until June 17, 1997, for completion of this submittal was requested by FPC's Manager of Nuclear Licensing and approved by Mr. L. Raghavan, NRR Project Manager. If you have any questions regarding this submittal please contact Mr. D. F. Kunsemiller, Manager, Nuclear Licensing at 352-563-4566.

Sincerely,

JJHolden

J. J. Holden
Director
Nuclear Engineering and Projects

JJH/jwt/gmv

Attachments

xc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager

Attachment 1

Evaluation of Crystal River Unit 3 Licensing Basis
for
RCS Attachment Piping

The approved design basis document for applicable codes is the Crystal River Unit 3 (CR-3) Final Safety Analysis Report (FSAR). The scope of piping which was qualified under USAS B31.7-1968 Draft, *Code for Pressure Piping, Nuclear Power Piping* (B31.7) Class 1 analysis is described in the text (Sections 4.1.3.2 and 4.1.3.5) and tables (4-2 and 4-6) of the FSAR. These text and tables include all of the primary loop piping, including attachment piping nozzles and connections as well as the pressurizer spray line and pressurizer surge line. All other Reactor Coolant System (RCS) attachment piping falls under FSAR Section 5.4.4, "Piping Design Criteria." This piping is designed and field hydro-tested in accordance with USAS B31.1.0-1967; *Code for Pressure Piping, Power Piping,* (B31.1) as indicated by FSAR Section 5.4.4. Therefore, FPC's position is that it has met the design and licensing requirements as stated in the FSAR text and tables.

Following is an expanded discussion of the design basis for the attachment piping in question.

DESIGN BASIS DISCUSSION:

FSAR Section 4.1.3.2 covers the RCS which includes the attached pressurizer spray piping and pressurizer surge piping. These piping systems are defined as part of the RCS and were originally analyzed in accordance with B31.7 as identified in FSAR Table 4-2. FSAR Section 4.1.3.2 states, "The design, fabrication, inspection, and testing of the RCS piping as listed in Table 4-6 are in accordance with USAS B31.7, *Code for Pressure Piping, Nuclear Power Piping,* dated February, 1968, and as corrected for Errata under date of June, 1968. Pursuant to applicable code boundary requirements, the feedwater header and the auxiliary feedwater header for the steam generator meet the requirements of the *Code for Pressure Piping, Power Piping,* USAS B31.1.0-1967." FSAR Section 4.1.3.5, "Attachments to Loop," states, "Nozzles on the RCS piping comply with Section 4.1.3.2 above, and nozzles on the vessels comply with Section 4.1.3.1 above."

FSAR Figure 4-1 (Referenced in Reference A) shows the RCS as well as attached piping systems for high pressure injection, make-up/letdown, post accident sample, decay heat removal, vents, drains, relief, and instrumentation. Some of the components in the attached systems have RCS tag numbers. However, as designed, they are not part of the RCS, since they are not listed in FSAR Table 4-6. The RCS terminates at the end of the respective nozzles listed in Table 4-6.

FSAR Figure 4-1 shows the Inservice Inspection (ISI) and "Nuclear" Class boundaries for the respective systems. Although these boundaries are shown as "original design basis code class boundaries," the actual "original design basis code class boundaries" are different and are described in the text of the FSAR. The boundaries in the figure are depicted by triangle and diamond shaped symbols. The Class boundaries shown in the triangles are the ASME Section XI Inservice Inspection boundaries as denoted by a 1, 2, or 3 in the triangle. The Class boundaries shown in the diamonds are the "Nuclear" class boundaries as denoted by N1, N2, or N3 in the diamond. The ISI boundaries are also the safety class boundaries, which were determined in accordance with Regulatory Guide 1.26 and correspond to the ASME Section III Class 1, 2, and 3 boundaries. FSAR Section 5.4.4 states, "Nuclear class piping systems have been fabricated, erected, shop-tested, and inspected with the intent of satisfying the applicable sections of the Code for Nuclear Power Piping USAS (ANSI) B31.7." The "Nuclear" piping requirements for fabrication, shop-testing, erection, and inspection are based on the requirements outlined in B31.7, Class 1, 2, and 3. However, for the attachment piping, FSAR Section 5.4.4 also states, "The basic guideline for the design and field hydro-testing of piping has been the Code for Pressure Piping USAS (ANSI) B31.1.0-1967 and those portions of Code Case N7."

Following is background information relative to the design basis for the subject piping. This shows little change from construction to the present time.

The construction permit for CR-3 is dated September 25, 1968 as identified in FSAR Section 1.4. Reference B is the initial issuance of the FSAR. The following information was extracted from Reference B:

> FSAR Section 1.3.2.8, *Piping*, states: "Reactor coolant piping will comply with USAS B31.7 - February, 1968 Draft."
>
> FSAR Section 1.3.2.12, *Piping*, states: "Power piping will comply with B31.1.0-1967. "Nuclear" piping other than Reactor Coolant piping is designed in accordance with B31.1.0-1967 but is being fabricated, tested, and inspected to B31.7-February, 1968 (Issued for Trial and Comment) by N1, N2, N3 classification. "Nuclear" piping as described above is used in systems that normally contain a radioactive substance."
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> FSAR Section 5.4.4, *Piping Design Criteria*, states, "Nuclear class piping systems have been fabricated, erected and inspected with the intent of satisfying the applicable sections of the CODE FOR NUCLEAR POWER PIPING USAS (ANS) B31.7. The basic guideline for the design of piping has been the CODE FOR PRESSURE PIPING USAS (ANS) B31.1.0-1967 and

those portions of Code Case N7. Pertinent sections from this CODE apply to Class I piping described hereafter:"

The following information exists in Revision 23 of the Updated FSAR:

FSAR Section 1.3.2.8, *Piping*, states: "Reactor coolant piping complies with USAS B31.7 - February, 1968 Draft."

FSAR Section 1.3.2.12, *Piping*, states: "Power piping complies with B31.1.0-1967. "Nuclear" piping other than RCS piping is designed and field hydro-tested in accordance with B31.1.0-1967; but is fabricated, shop-tested, erected, and inspected to B31.7-1969 including Code Case B31-83 (October 1970) by N1, N2, N3 classification. "Nuclear" piping as described above is used in systems that normally contain a radioactive substance."

FSAR Section 5.4.4, *Piping Design Criteria,* states, "Nuclear class piping systems have been fabricated, erected, shop-tested, and inspected with the intent of satisfying the applicable sections of the Code for Nuclear Power Piping USAS (ANSI) B31.7.'

'The basic guideline for the design and field hydro-testing of piping has been the Code for Pressure Piping USAS (ANSI) B31.1.0-1967 and those portions of Code Case N7. Pertinent sections from this Code apply to Class I piping described hereafter:"

The design code (B31.1) for the attachment piping does not require a rigorous fatigue analysis. However, the basic concept for cyclic fatigue is addressed in Section 102.3.2 of B31.1. This takes into consideration the appropriate stress range reduction factors for cyclic conditions and has 7000 allowable full thermal cycles.

The conclusions drawn from the above discussion are as follows:

1. The licensing and design basis for the RCS piping as defined in FSAR Sections 1.3.2.8 and 4.1.3.2 is USAS B31.7.

2. The licensing and design basis for the RCS attachment piping as defined in FSAR Sections 1.3.2.12 and 5.4.4 is USAS B31.1.0

3. The reactor coolant piping and integral nozzles as listed in FSAR Table 4-6 are designed and analyzed in accordance with USAS B31.7, draft dated February, 1968 and as

corrected by Errata dated June 1968 which is consistent with FSAR Sections 1.3.2.8 and 4.1.3.2.

4. The attachment "Nuclear" piping was designed and analyzed in accordance with B31.1.0, 1967 Edition which is consistent with FSAR Sections 1.3.2.12 and 5.4.4.

5. The design and analysis, as outlined in FSAR Amendment 11 and Revision 23 of the CR-3 Updated FSAR, has remained essentially unchanged for the Reactor Coolant System and the attached "Nuclear" piping as defined by FSAR text and tables.

RESTART DISCUSSION:

The attachment piping in question is included in the ISI Program, and therefore subject to the rigorous inspections and corrective actions included in that program. No indications of fatigue damage have been discovered to date as a result of these inspections.

Additionally, the nozzles for the RCS attachment piping have fatigue evaluations and usage factors associated with them in accordance with B31.1. Typically, when fatigue evaluations are performed for attachment RCS piping, the nozzle is the controlling component for a given analytical model.

It is for these reasons that the issue of Class 1 piping analysis is not considered a restart constraint to the restart of CR-3 from the current outage.

Attachment 2

List of Regulatory Commitments

The following table identifies those actions committed to by Florida Power Corporation in this document. Any other actions discussed in the submittal represents intended or planned actions by Florida Power Corporation. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager, Nuclear Licensing of any questions regarding this document or any associated regulatory commitments.

ID NUMBER	COMMITMENT	COMMITMENT DATE
3F0697-21-1	FPC will develop a program, plan and schedule for performing necessary Class 1 fatigue analyses by September 30, 1997.	9/30/97