Public Service Company of Colorado

12015 East 46th Avenue, Suite 440; Denver, CO 80239

August 29, 1980
Fort St. Vrain
Unit No. 1
P-80281

Mr. Robert L. Tedesco
Assistant Director of Licensing
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. 50-267

Subject: Thermal Stresses in Core Support Blocks

References: (1) NRC letter from S.A. Varga to D.W. Warembourg, G-79144, dated August 16, 1979

(2) NRC letter from S.A. Varga to D.W. Warembourg, G-79162, dated September 19, 1979

(3) LASL letter Q-13:80:218 from Thomas Butler, LASL, to Dr. Michael Tokar, NRC, dated July 16, 1980

(4) NRC letter from R.L. Tedesco to J.K. Fuller, G-80130, dated August 2, 1980

Dear Mr. Tedesco:

References (1) and (2) notified the Public Service Company of Colorado (PSC) in 1979 that the Oak Ridge National Laboratory (ORNL) had used the ORECA code to predict that large temperature differences would exist between adjacent Fort St. Vrain (FSV) refueling regions during a firewater cooldown following a 90 minute loss of forced circulation (LOFC) accident, and that the NRC was having Los Alamos Scientific Laboratory (LASL) determine if these large differential temperatures resulted in excessive thermal stresses in core support blocks. At a meeting with NRC and PSC on November 1, 1979, LASL reported that various preliminary thermal stress calculations had all resulted in acceptable stress levels. At the November 1, 1979 meeting, the NRC stated that no action by PSC was required or requested at that time.

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Reference (3), which was informally submitted to PSC in July 1980, was the first indication that the large differential temperatures in the core support block area might result in high calculated thermal stresses under postulated accident conditions.

Upon receipt of reference (3), PSC and the General Atomic Company (GAC) initiated an intensive review of the LASL thermal stress work completed since last November 1, 1979. Preliminary technical discussions with LASL and ORNL personnel were held, and arrangements were made for a technical meeting between, PSC, GAC, LASL and ORNL on August 25, 1980, the earliest date on which key LASL and ORNL personnel were available.

Subsequent to these activities, PSC received reference (4) from the NRC officially forwarding reference (3) to PSC. Reference (4) asked for PSC to reply to the LASL thermal stress analysis and discuss the potential crack stability and propagation effects and the effects the LASL analysis might have on the operation of the Fort St. Vrain reactor. Reference (4) requested PSC to reply by August 29, 1980.

A technical meeting was held on August 25, 1980 between personnel from LASL, ORNL, GAC, PSC and NRC to review the recent LASL results and develop recommended approaches to further define and resolve the potential thermal stress concerns. At the meeting LASL presented the results of their thermal stress analysis for the highest differential temperature region of a worst case FSV equilibrium core (full fission product inventory) operating at the technical specification limits for region temperature dispersion and region power peaking factors. This worst case equilibrium core was assumed to be operating at a 105 percent power level at the onset of an LOFC accident followed by a firewater cooldown 90 minutes into the LOFC.

At present, it is not clear what the net effect of the various analytical models and assumptions used by LASL might be on the calculated stresses, as compared to stresses which might be calculated using more rigorous and time consuming forms of analyses. At the meeting GAC identified several factors including, but not limited to, the effects of radiation heat transfer and the widely varying temperatures of the six blocks surrounding the hot core support block, that were not explicitly accounted for in the LASL analyses and which could significantly affect the calculated thermal stresses. PSC and GAC are continuing to review the LASL thermal analyses that were performed using the assumed worst case equilibrium core and the postulated accident conditions to ascertain if a real problem in fact exists.

Based on several ORECA sensitivity studies performed by ORNL in preparation for the August 25, 1980 meeting, PSC is confident that a thermal stress problem does not exist with the current FSV Cycle 2 core and the present 70 percent thermal power limitation. Further, it is likely that even under full power conditions the Cycle 2 core, due to the relatively uniform Cycle 2 region power peaking factors, will not experience excessive thermal stresses under postulated accident conditions. Because of their recent activities, ORNL and LASL at this time are in the best position to immediately analyze core support block temperature distributions and thermal stresses. Therefore, to confirm these Cycle 2 conclusions on an expeditious schedule, ORNL and LASL participation in the analysis of the Cycle 2 FSV core will be necessary.

To better define the thermal stresses which may occur under postulated accident conditions, and the consequences of these thermal stresses, it was the consensus of the participants in the August 25, 1980 meeting that the following actions should be undertaken in the short term:

1. GAC will identify 2 to 3 bounding sets of Cycle 2 core performance parameters within or up to technical specification limits and will provide these Cycle 2 parameter sets to ORNL and LASL for thermal analysis.

2. ORNL will enhance the axial node detail of the ORECA code in the area of the bottom reflector elements and core support blocks to provide more temperature nodes and heat transfer rates between nodes for use by LASL. ORNL will take the GAC Cycle 2 core performance parameters and use the enhanced ORECA code to calculate bulk graphite temperatures and heat transfer rates between nodes for the Cycle 2 core.

3. LASL will perform the necessary 2-D and 3-D analyses to match the ORECA temperature patterns and calculate the associated thermal stresses for the 2 or 3 bounding sets of Cycle 2 core performance parameters to confirm there would not be an immediate thermal stress problem under Cycle 2 postulated accident conditions.

4. GAC will continue in their efforts to obtain permission from DOE to release the following reports concerning core support graphite fracture properties. Upon receipt of DOE permission, GAC will submit the core support graphite reports to PSC, NRC and LASL for information.

    a. Test Evaluation Report of the Thermal Stress Test for Core Support Graphite

    b. Test Evaluation Report for PGX Fracture Mechanics

    c. Graphite Design Material Properties

5. GAC will perform scoping studies and analyses to determine if a core support block with thermal stress cracking would be able to continue to perform its core region support function.

6. LASL, ORNL, GAC, PSC and NRC representatives will reconvene in approximately one month to review the results of these short term efforts and determine the scope and direction of any long term efforts which may be required to resolve the potential core support graphite high thermal stress condition during a firewater cooldown following an LOFC.

By copy of this letter, the cooperation and participation of ORNL and LASL in performing the above short term analyses and efforts is hereby requested. PSC intends to pursue the resolution of the high calculated thermal stress concern in as short a time frame as possible, and use of the immediately available ORNL and LASL capabilities would greatly aid this effort.

If there are any questions or comments concerning the above approach to the potential high thermal stress condition, please contact PSC immediately.

Very truly yours,

J.K. Fuller, Vice President
Engineering and Planning

JKF/MHH:pa

cc: Mr. Ron Foulds
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