844

7/30/85

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
GEORGIA POWER CO.	)	Docket Nos. 50-424
et al.	)	50-425
	)	(OL)
(Vogtle Electric Generating Plant,	)	
Units 1 and 2)	)	

NRC STAFF RESPONSE TO APPLICANTS' MOTION FOR SUMMARY DISPOSITION OF CONTENTION 11 (STEAM GENERATORS)

I. INTRODUCTION

On July 5, 1985, Applicants filed a Motion for Summary Disposition of Joint Intervenors' Contention 11 which alleges that Applicants have not demonstrated that no unacceptable radiation releases will occur as a result of certain specified steam generator tube failures. The Staff responds to Applicants' Motion herein; for the reasons presented below and in the attached Affidavits of Jai Raj Rajan and William LeFave, the Staff submits that the Motion should be granted.

II. LEGAL STANDARDS GOVERNING SUMMARY DISPOSITON

The Staff previously set forth the applicable legal standards governing motions for summary disposition in its July 26, 1985 "Response to Applicants' Motion for Summary Disposition of Contention 10.3 (Cables in Multiconductor Configurations)" (at pp. 1-3). In order to avoid

DS07

unnecessary repetition, that discussion is incorporated by reference herein.

III. APPLICANTS' MOTION

In its order of September 5, 1984, the Board admitted portions of Joint Intervenors' Contention 11, and reworded that contention as follows:

> Applicants have not demonstrated their basis for confidence that no unacceptable radiation releases will occur as the result of steam generator tube failures occasioned by vibration-induced fatigue cracking and by bubble collapse within the Vogtle steam generators.

LBP-84-35, 20 NRC 887, 908 (1984). The Staff will examine the issues of vibration-induced fatigue cracking and bubble collapse seriatim. For the reasons presented below, neither issue poses a problem for the safe operation of the Vogtle facility and, accordingly, the Staff supports Applicants' Motion for Summary Disposition of Contention 11.

A. Vibration-Induced Fatigue Cracking

Vibration-induced fatigue cracking is a failure mechanism in which excessive vibration of a flexible member such as a steam generator tube can result in a cyclic deflection or bowing of the tube between its supports. This cyclic deflection can generate stresses causing the tube walls to undergo degradation or fatigue and eventually, after a finite number of cycles, to crack and fail. If vibration of the tubes is kept within certain limits, the tube walls can tolerate, without cracking, an infinite number of cycles. This limit is defined as the endurance limit of the tube. If vibrations are kept below the endurance limit,

vibration-induced fatigue cracking and failure should not occur. Rajan Affidavit, ¶¶ 3-4.

The Westinghouse Model F steam generators which are installed at Vogtle are accurately described in detail in the Affidavit of Carl Hirst attached to Applicants' Motion. The NRC Staff has reviewed the Westinghouse U-tube type steam generator (including the Model F) and has determined that vibration-induced fatigue cracking should not be a problem. This conclusion is based upon the following:

a) Operational experience with the Westinghouse U-tube type steam generators to date has not revealed any vibration-induced fatigue cracking. This experience, which includes Model F steam generators, is documented in NUREG-0886 ("Steam Generator Tube Experience", Feb. 1982) and NUREG-0606 ("Unresolved Safety Issues Summary", Aug. 17, 1984).

b) The NRC Staff has reviewed the analytical results and model test data obtained by Westinghouse to evaluate the secondary flow in the Westinghouse Model F steam generators. This review indicates that the vibratory stresses in the tubes in the various regions of the steam generator are likely to be well under the endurance limit. The Westinghouse evaluation included the parallel and cross flow excitation and the three vibration mechanisms: vortex shedding, fluid-elastic excitation and turbulence. The results indicate that vibration-induced fatigue cracking should not be a concern with Model F steam generators.

c) The first operating plant with Model F steam generators was instrumented to monitor vibration of the tubes during actual operation. The vibration data under plant operating conditions revealed no excessive vibration and were consistent with the analytical and model test results.

Rajan Affidavit, ¶¶ 5-9. Based on the Staff's evaluation of the analytical and model test results, as well as the operational data generated for the Model F generator, the Staff has concluded that vibration-induced fatigue cracking is highly unlikely to occur in Westinghouse Model F steam generators. Id., ¶ 10.

Further, while the Staff does not expect vibration-induced fatigue cracking to occur in Model F generators, even if a crack were to occur, no appreciable releases of radiation should result. The Vogtle technical specifications provide an additional level of protection, by specifying permissible primary-to-secondary system leakage limits for the steam generators. Any time a leakage rate is exceeded, the plant must shut down and appropriate remedial action must be initiated. These limits are set at such a low level that even in the unlikely event a fatigue-induced crack does propagate through a wall and cause a leak, the leak should be detected, the plant shut down, and remedial measures initiated before any appreciable amounts of radiation could be released due to the leak. Rajan Affidavit, ¶ 11.

Joint Intervenors have also raised a concern about fretting. Fretting wear of steam generator tubes can result from vibratory impacts or rubbing between the tubes and other metal parts such as support plates. Fretting is a distinct issue from vibration-induced fatigue

cracking, and as such is not properly raised in the Contention. In any event, fretting is not a matter of concern for Model F generators. Fretting wear was observed in the preheat region of Westinghouse Model D steam generators. The problem was caused by a high level of flow turbulence in the preheat region. The Model F generator has no preheat region and has been designed to preclude the possibility of fretting wear by reducing the level of flow turbulence. The Staff has reviewed the Model F design and agrees that fretting should not be a concern for Model F generators. Rajan Affidavit, ¶ 12. Fretting is thus neither part of the admitted contention nor should it pose a problem at the Vogtle facility.

In conclusion, analyses, tests and operational evidence indicate that the Model F generator used at Vogtle should not experience vibration-induced fatigue cracking. Even in the unlikely event a crack should occur, the facility's technical specifications should lead to detection of the existence of the crack and plant shutdown before the public health and safety is adversely affected. For these reasons, summary disposition of that portion of Contention 11 that deals with vibration-induced fatigue failure is appropriate.

B. Bubble Collapse

Bubble collapse is a type of water hammer occurrence induced by condensation of a steam pocket in the steam generator feeding or the feedwater piping leading to the steam generator. Bubble collapse water hammer was one of several types of water hammer evaluated by the NRC Staff in resolving Unresolved Safety Issue (USI) A-1. In March 1984, the Staff published its resolution of USI A-1, in NUREG-0927 ("Evaluation of Water

Hammer Occurrence in Nuclear Power Plants - Technical Findings Relevant to Unresolved Safety Issue A-1") and NUREG-0993 ("Regulatory Analysis for USI A-1, 'Water Hammer'"). LeFave Affidavit, ¶ 4.

One of the results of the resolution of USI A-1 was adoption of the design considerations and preoperational test recommendations described in Auxiliary Systems Branch (ASB) Branch Technical Position (BTP) 10-2 (a copy of which is attached to the LeFave Affidavit). The Staff has determined that compliance with BTP ASB 10-2 provides an acceptable means of protection against water hammer events. LeFave Affidavit, ¶ 5.

Applicants have followed the guidance of BTP ASB 10-2 in the design of the Vogtle steam generators. In addition, the Applicants have committed to perform preoperational testing to verify that the unit operating procedures do not result in steam bubble collapse water hammer in the main or auxiliary feedwater system. LeFave Affidavit, ¶ 6.

The potential for bubble collapse water hammer in the feedring of the Model F steam generator used at Vogtle has been minimized by the use of J-tubes and a welded thermal sleeve (to prevent draining the feedring when no flow is present), thereby preventing steam bubble formation. In addition, by introducing auxiliary feedwater (AFW) flow into a separate steam generator nozzle in lieu of the feedring, the colder auxiliary feedwater will not contact the warmer feedwater in the feedring or any steam in the feedring, thereby minimizing the possibility of condensation-induced bubble collapse (water hammer). The probability of steam bubble collapse water hammer has been significantly reduced in the Vogtle design by these measures. Id., ¶¶ 6-7.

The Vogtle design also follows the recommendations of BTP ASP 10-2 regarding the shortest possible horizontal run of inlet piping to the steam generator feedring and auxiliary feedwater nozzle, to prevent highpoint steam pockets. During normal plant operation, the AFW inlet piping is kept full of water by the main feedwater system via bypass piping. The discharge end of the inlet piping in the steam generator is below the normal operating water level. Additionally, four check valves in series are provided between the AFW inlet nozzle and the AFW pump recirculation lines to minimize the possibility of backleakage under no flow conditions. Thus, steam bubble formation in the AFW inlet nozzle and piping is not expected to occur. LeFave Affidavit, ¶ 8.

In conclusion, the Staff has taken the position that the generic water hammer "unresolved safety issue" is now resolved and that, if ASB BTP 10-2 is followed, the public health and safety will not be endangered by steam generator tube degradation due to bubble collapse water hammer. The Staff has reviewed the Vogtle design.features intended to minimize the potential for bubble collapse water hammer. As indicated in Section 10.4.7 of the Vogtle Safety Evaluation Report, the Staff has concluded that the Vogtle design meets the Staff's criteria with respect to the prevention of bubble collapse water hammer as set forth in ASB BTP 10-2, and that the design is acceptable. LeFave Affidavit, ¶¶ 5,9. For these reasons, the Staff has conluded that steam bubble collapse water hammer does not present a concern for the Vogtle facility, and therefore supports Applicants' Motion for Summary Disposition of Contention 11 as it relates to this issue.

IV. CONCLUSION

For the reasons presented above, the Staff submits that Applicants' Motion for Summary Disposition of Contention 11 should be granted.

Respectfully submitted,

Robert G. Perlis
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 30th day of July, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
GEORGIA POWER CO.	)	Docket Nos. 50-424
et al.	)	50-425
	)	(OL)
(Vogtle Electric Generating Plant,	)	
Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE TO APPLICANTS' MOTION FOR SUMMARY DISPOSITION OF CONTENTION 11 (STEAM GENERATORS)" and Supporting Documents in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 30th day of July, 1985.

Morton B. Margulies, Esq., Chairman*
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Gustave A. Linenberger, Jr.*
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. Oscar H. Paris*
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Bradley Jones, Esq.
Region 1 Counsel
U.S. Nuclear Regulatory Commission
Suite 3100
101 Marietta Street
Atlanta, GA 30303

Bruce W. Churchill, Esq.
David R. Lewis, Esq.
Shaw, Pittman, Potts & Trowbridge
1800 M Street, N.W.
Washington, D.C. 20036

Douglas C. Teper
1253 Lenox Circle
Atlanta, GA 30306

Atomic Safety and Licensing
Board Panel*
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docketing and Service Section*
Office of the Secretary
U.S. Nuclear Regulartory Commission
Washington, D.C. 20555

James E. Joiner, Esq.
Troutman, Sanders, Lockerman,
& Ashmore
127 Peachtree Street, N.E.
Candler Building, Suite 1400
Atlanta, GA 30043

Tim Johnson
Executive Director
Campaign for a Prosperous Georgia
175 Trinity Avenue, S.W.
Atlanta, GA 30303

Laurie Fowler, Esq.
218 Flora Ave. NE
Atlanta, GA 30307

Atomic Safety and Licensing
Appeal Board Panel*
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Ruble A. Thomas
Southern Company Services, Inc.
P.O. Box 2625
Birmingham, AL 35202

Robert G. Perlis
Counsel for NRC Staff