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U. S. Nuclear Regulatory Commission
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Subject: Oconee Nuclear Station
Doc. Nos. 50-269, -270, -287
Installation of Cavitating Venturi

On October 17, 1989, Duke Power personnel met with the NRC Staff to discuss pump runout protection for the Oconee Emergency Feedwater (EFW) pumps. This meeting was requested by me in a letter dated June 20, 1989. The purpose of the meeting was to discuss, in depth, the reasons for revising our previous commitment to implement a hardware fix to reduce operator burden during postulated accidents with low steam generator pressure. As discussed during the October 17, 1989, meeting we have been evaluating various options to address this concern, and to date have not been able to identify an optimum solution. Accordingly, we do not intend to implement any hardware fix to address this concern. As such, I am withdrawing my commitment to install cavitating venturies or any other modification in order to relieve operator burden in ensuring that the EFW pumps are protected from runout in postulated accidents with low steam generator pressure. The basis for this change was discussed in depth during the October 17, 1989 meeting. We will continue to assure operator awareness of this potential problem, through training and procedures.

In addition during the October 17, 1989 meeting, the vibration problems with installing cavitating venturies into Oconee EFW system was discussed. The NRC requested that Duke provide additional information regarding this problem. To this end, please find attached the requested information.

Very truly yours,

J W Hampton
for

H. B. Tucker

PFG/78/td

Attachment

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OCONEE UNITS 1, 2, and 3
Cavitating Venturi
Vibration Problems

To solve the potential problem with EFW pump runout and enhance the operation of the EFW system, cavitating venturis were selected as a possible passive solution that might effectively reduce operator burden without complicating the system.

Following the design and manufacture of the venturis, the venturis were installed in a temporary test loop and operated to verify functional performance and measure vibration created in downstream piping. The piping response under postulated worst case cavitating conditions resulted in vibration velocities in excess of 10 ips-pk (pegging the meter) and accelerations in excess of 60 g's.

While it is generally accepted that the piping vibration is highly dependent upon the piping geometry and support configurations, it is also known from failure experiences that cantilevered vents and drains, as well as valve actuators, can have vibration responses several times higher than the run piping for cavitation type input. The greater response of these components to the high level of "white noise" is attributed to the poor overall damping available in combination with excitation of natural frequencies from the broad frequency range forcing function.

Inasmuch as (1) the Duke piping in question near the proposed location of the cavitating venturi does contain cantilevered attachments and (2) we expect that, based on our experience, this piping would be highly susceptible to short term vibration fatigue, we cannot recommend installation of the cavitating venturi as a solution to our problem with EFW pump runout.

This opposition is further reinforced by our concerns that if we were to install the venturi, a lengthy data acquisition testing effort would be required to adequately evaluate the systems functional integrity under the conditions generated by the cavitating venturi. Following data collection, the unit would be considered inoperable for days or perhaps weeks while analytical efforts were made to qualify the vibration and calculate the allowable remaining fatigue stress cycles not consumed by the testing. Efforts to limit stress cycles and allow a greater alternating stress intensity would quickly reduce the allowable run time. This could force tracking of the stress cycles during actual unit operation resulting in extensive permanent instrumentation, monitoring equipment, and evaluation expense.

Also, the demands of the Duke system configuration would have required placement of a venturi immediately upstream of a secured cabinet containing several valves and branch connections. Because of the high vibration susceptibility of these components, extensive data collection and additional compensatory security measures in these areas would have been required during the attempted qualification testing.

Furthermore, discussions with another utility having cavitating venturis installed in a simple piping configuration reinforced the belief that qualification would likely be much more difficult, if at all possible, for Duke's complicated piping geometry.

In summary, many factors pointed to the decision not to attempt installation and qualification of the cavitating venturis. Among them were previous experiences with high vibration failures and comments from other utilities concerning qualification difficulties for much simpler piping systems, as well as, vibration results from the test loop.