



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION REPORT BY THE OFFICE OF SPECIAL PROJECTS

EMPLOYEE CONCERN ELEMENT REPORT 22901

"QUESTIONABLE CALCULATION OF ORIFICE HOLE DESIGN"

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

I. SUBJECT

Category: Engineering (20,000)
Subcategory: Instrumentation and control design (22900)
Element: Questionable Calculation of Orifice Hole Design (22901)
Employee Concern: NS-85-004-001 and PH-85-022-001

Element Report 22901, Revision 3, prepared March 31, 1987, involves two similar employee concerns. One concern states, "Orifice plates installed in many plant systems, both Units 1 and 2 (Watts Bar) have incorrect hole size which will result in false flow readings. The same condition may exist at Sequoyah." The other concern states, "Orifice plates received under contract #83520-1 are in error because the bore sizes were not calculated using a flow coefficient based on Reynolds number."

II. SUMMARY OF ISSUE

Flow orifice plates, supplied by Meriam Instrument Company, were alleged to have an incorrect hole size because of the use of a plane equation, which did not account for the inertial to viscous force effect of the Reynolds Number, rather than a precise equation. The incorrect hole size was alleged to result in false (i.e., inaccurate) flow readings. The TVA employee concern special program (ECSP) task team investigated the calculational data, industry methodologies for setting orifice bore sizes and TVA Design Standards, and performed independent calculations of the differential flow effect of hole size variations. Manufacturing tolerance was eliminated as a factor in this evaluation. The ECSP report determined that consideration of Reynolds Number effects was appropriate for precise mixing or close tolerance applications, but stated that such provision was not necessary for the uses made of orifice plates in the Sequoyah plant.

III. EVALUATION

NRC and its consultant, SAIC, reviewed the concern and the TVA findings. The TVA ECSP report established that the orifice plates in question were used in both safety-related and nonsafety-related systems. The safety-related systems included component cooling water, essential raw cooling water, main steam, and feedwater systems. The flow orifices were used to initiate high and low alarms or to start and stop equipment, and no instances involved flow control modulation with flow as the primary variable.

In general these orifice plates are used in application for qualitative rather than precise quantitative information. TVA has also reviewed the list of all orifice plates against the signals required for Reg. Guide 1.97. From this list TVA selected the orifice plates supplied under Meriam contract and calculated the differences between plane and precise equations for these flow elements. Based on these calculations, the differences between the flow signal ranged from 2.49 to 2.68 percent which is insignificant for each of the Sequoyah applications. However, TVA has agreed to revise calculations for flow measurement developed from orifice plates to accommodate potential errors introduced by sizing calculational method.

IV. CONCLUSION

The expressed concern was valid in that a precise equation was not used in existing TVA instrument loop accuracy calculations; however, the effect of this omission was approximately 2 to 3 percent and is negligible for Sequoyah applications. Since the present error is in the conservative direction and that inaccuracies are insignificant, staff finds TVA proposed schedule to reissue safety calculations after restart acceptable.

Based on this, the NRC staff concludes that TVA's investigation, evaluation and corrective action plan to resolve the employee concern as described in EN-22901, Rev. 3 are adequate.