

ENCLOSURE

SEQUOYAH NUCLEAR PLANT UNIT 1
FLEXIBLE BELLOWS PENETRATIONS OF STEEL
CONTAINMENT VESSEL MISALIGNED DURING INSTALLATION

NCR 1666

10 CFR 50.55(e)

REVISED FINAL REPORT

Description of Deficiency

During hot functional preoperational testing at unit 1 of Sequoyah Nuclear Plant, removal of the bellows restraints on 32 bellows penetrations of the steel containment vessel (SCV) revealed that those bellows restraints were misaligned. This deficiency is considered reportable because three of the bellows penetrations might have leaked containment atmosphere to the annulus region (between the SCV and concrete containment) when subjected to the deflections associated with a postulated safe shutdown earthquake (SSE) or design basis accident (DBA). The balance of the 32 bellows penetrations were analyzed by the manufacturer (Tube Turns, Louisville, Kentucky) and found to be acceptable with the present misalignment to operate when subjected to the deflections associated with an SSE or DBA without containment leakage.

The apparent cause of this deficiency is a faulty installation sequence that permitted the containment-to-bellows weld to be completed before making process pipe closure welds. Hence, slight misalignment of the piping resulted in misalignment of the bellows.

Safety Implications

If this deficiency had remained uncorrected, it is possible that 3 of 32 bellows penetrations might possibly have failed when subjected to the deflections associated with a postulated SSE or DBA. In this context, a failure would be a small split in the bellows which would permit leakage of the containment atmosphere into the annulus area.

Corrective Actions

TVA inspected all bellows penetration assemblies in the SCV and took alignment data. The alignment data was analyzed by the bellows manufacturer. Following analysis, the bellows manufacturer placed the bellows in three categories.

1. Those bellows (three in number) that analysis could not ensure would survive their misalignment plus the deflections associated with a postulated SSE or DBA without the possibility of a leakage
2. Those bellows (15 in number) that analyses showed would survive their misalignment plus the deflections associated with a postulated SSE or DBA, but would require inspection before continued operation

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3. Those bellows (14 in number) that analyses showed would be completely satisfactory for 40 years life with their installed misalignment plus the deflections associated with a postulated SSE or DBA

The three bellows which were not capable of surviving the deflections associated with a postulated SSE or DBA without possible leakage as installed were reinstalled. During the reinstallation process, no problem other than the misalignment was found. The proper installation sequence was strictly followed during reinstallation of these three bellows. Measurements made following reinstallation of two of these three bellows (X-33 and X-108) ensured that they would be completely satisfactory over 40 years of plant life. Measurements made on the other bellows (X-109) were analyzed as being satisfactory with its misalignment to survive the deflections associated with a postulated SSE or DBA with a required inspection before continued operation.

Means Taken to Prevent Recurrence

Sites where TVA has nuclear plants under construction have been requested to reemphasize to craft employees installing bellows that construction efficiency requires proper alignment of piping and bellows nozzles before installation welding. At Sequoyah Nuclear Plant, the installation of all remaining bellows penetrations will be controlled by detailed installation instructions and will be under the control of systems engineers in the Mechanical Engineering Unit.

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