

TENNESSEE VALLEY AUTHORITY

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MAR 18 1988

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of) Docket Nos. 50-327
Tennessee Valley Authority) 50-328

SEQUOYAH NUCLEAR PLANT (SQN) - STEAM GENERATOR TUBE RUPTURE (SGTR) -
POTENTIAL UNREVIEWED SAFETY QUESTION

Westinghouse Electric Corporation notified TVA of a potential unreviewed safety question involving the dose consequences of an SGTR event. TVA has evaluated this information and made a preliminary determination that SQN may be affected.

In order to facilitate restart, TVA is instituting interim actions that will be completed before the restart of unit 2 to ensure that the consequences of an SGTR event, even with very conservative bounding assumptions, remain within regulatory limits. The bounding assumptions made by TVA are very conservative; however, TVA has chosen to address the issues of tube bundle uncovering and iodine partitioning in a straightforward, timely, and direct manner for unit 2 restart. Future actions on the part of TVA and the industry will remove the unrealistic conservatism from these calculations. TVA will maintain the interim actions until generic industry actions obviate the need for interim actions or when other TVA or industry solutions are accepted.

TVA's assessment is included as enclosure 1. Commitments made in this letter are included as enclosure 2.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosures
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U.S. Nuclear Regulatory Commission

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Enclosure 1

Sequoyah Nuclear Plant

STEAM GENERATOR TUBE RUPTURE POTENTIAL UNREVIEWED SAFETY QUESTION

Historical Information

The offsite dose associated with a steam generator tube rupture (SGTR) event was evaluated by TVA in the Final Safety Analysis Report (FSAR) for Sequoyah Nuclear Plant (SQN). As noted in section 15.5.5, the FSAR analysis used an iodine partition factor in the SGTR dose calculation. The radiological consequences of an SGTR event were also evaluated by NRC in section 15.4.4 of the safety evaluation report (SER) for SQN (NUREG-0011). The NRC evaluation also used an iodine partition factor.

The NRC Standard Review Plan (SRP) outlines two cases to be reviewed for SGTR dose consequence in section 15.6.3: a preaccident iodine spike (60 uCi/gram iodine concentration) and a concurrent iodine spike (1 uCi/gram iodine concentration).

Potential Problem

The Westinghouse Electric Corporation (W) notified TVA of a potential unreviewed safety question regarding the dose consequences of an SGTR event. This issue was identified to W by a utility. Specifically, the issue regarded an increase in the radioactivity release to the environment following an SGTR because of the uncovering of the steam generator tubes following reactor trip. Failure to maintain water level above the tube bundle may potentially increase the radioactivity release to the environment during the uncovering period. The most conservative leak location is at the top of the tube bundle. Hence, uncovering of the bundle potentially creates a direct activity release path to the environment because there will be neither dilution by the secondary side water nor partitioning of the iodine carried by the leakage flow. The SGTR event is the limiting dose consequence analysis that is affected by tube bundle uncovering. The steam line break and control rod ejection events are also affected; however, neither analysis has a large component of reactor coolant leakage being released to the environment. As a result, the dose consequences are not affected as greatly as the SGTR event.

TVA Conservative Evaluation

TVA has reevaluated the SGTR event dose calculation presented in the FSAR to address the potential unreviewed safety question raised by W. TVA has chosen to address the issues of tube bundle uncovering and iodine partitioning in a direct, straightforward, simple, and timely manner for unit 2 restart. In particular, two very conservative computer model changes were made to bound the effects of iodine partitioning and tube bundle uncovering. Two other changes were made regarding the time of reactor trip and the total reactor coolant released to the defective steam generator because of the availability of new information.

First, the iodine partition factor was set equal to 1.0 (no partitioning) during tube bundle uncovering to bound the effects of tube bundle uncovering. This change is very conservative because recent test results indicate that iodine partitioning may still occur even with tube bundle uncovering. (See the following section for further discussion on conservatism.)

Second, the tube bundle was assumed to be uncovered for the entire time between reactor trip and isolation of the defaulted steam generator to bound the effects of tube bundle uncovering. This change is very conservative, because both the auxiliary feedwater system and the reactor coolant leak will work to recover steam generator level.

Third, reactor trip was assumed to occur approximately 5 minutes after the initiation of the SGTR event. This change was made as a result of an SQN-specific analysis that was previously performed by W. As noted in section 15.4.4 of the SER, reactor trip was previously assumed to occur 15 minutes after initiating the SGTR event. The impact of this change is to increase the time of tube bundle uncovering and decrease the time that releases are made through the condenser where additional iodine partition occurs. Both of these effects increase the calculated dose consequence.

Fourth, the total reactor coolant release to the defective steam generator used in the TVA conservative analysis was 92,500 pounds. The FSAR analysis previously used 125,000 pounds. The new mass release was based on W calculations that are applicable to SQN; this information was previously submitted to NRC as part of the Westinghouse Owners Group (WOG) work on SGTR. The effect of this change is to reduce the total amount of radioactive iodine available for release to the environment. This change reduces the calculated dose consequence.

To model the concurrent iodine spiking effects, the TVA calculation assumed a factor of 10 iodine increase at the time of SGTR. The reactor coolant iodine concentration was assumed to be 1 uCi/gram before SGTR and 10 uCi/gram after SGTR. This model is slightly different than NRC guidance presented in SRP, section 15.6.3; however, the two models yielded similar results when TVA attempted to duplicate the NRC results using the SER assumptions (approximately 16 rem thyroid [TVA] and 19 rem thyroid [NRC]).

The result of the TVA conservative calculation was 37.9 rem thyroid at the site boundary. The calculated dose is slightly higher than the NRC acceptance criteria listed in SRP, section 15.6.2, part II.2, for the concurrent iodine spike. The calculated dose is still within the limits of 10 CFR Part 100. TVA estimated the dose consequences for the 60 uCi/gram preaccident iodine spike case by using the ratio of iodine concentrations. A ratio of 6 in iodine concentration (60 uCi/gram versus 10 uCi/gram) was used to calculate the dose consequences. The 37.9 rem dose was increased by a factor of 6 to 227.4 rem. This dose meets the acceptance criteria of 300 rem in SRP, section 15.6.3, part II.1.

Mitigating Information

The TVA conservative evaluation assumes tube bundle uncovering from reactor trip to faulted steam generator isolation (25.7 minutes) in order to conservatively bound the tube bundle uncovering period. In fact, for an SGTR event, both the reactor coolant leak and auxiliary feedwater will work to recover steam generator level; and the reactor coolant leak will continue to fill the steam generator. Specific thermal hydraulic calculations have not been performed for the SGTR event; however, steam generator water levels generally recover within minutes following a reactor trip. The addition of reactor coolant leakage would make recovery quicker.

The TVA conservative evaluation takes no credit for iodine partitioning in order to conservatively bound the effects of tube bundle uncovering. In fact, recent tests conducted jointly by the Electric Power Research Institute (EPRI), W, NRC, and the Central Electricity Generating Board of the United Kingdom (EPRI - RP 1845) indicate greater safety margins than those used in current prescriptions for licensing calculations and safety analysis reports. The principal observation during the test program was that little or no primary coolant bypassing was detectable under steady-state SGTR fault conditions--either when water was at normal levels or when the break location was exposed.

The TVA evaluation also makes other standard conservative assumptions that make the evaluation worst-case. These assumptions include worst-case meteorological conditions, loss of offsite power after reactor trip, and loss of condenser after reactor trip.

TVA Interim Actions

In order to facilitate unit 2 restart, TVA has performed very conservative bounding calculations for the dose consequences of an SGTR event. The analysis with a concurrent iodine spike resulted in a calculated dose greater than the recommended acceptance criteria in SRP, section 15.6.3, part II.2. Rather than perform thermal hydraulic calculations to define appropriate tube bundle uncovering times or use iodine partitioning factors based on very recent industry tests before restart, TVA will institute an administrative limit on reactor coolant radioactive iodine concentrations. This action will provide added assurance that the dose consequence of an SGTR event will remain within regulatory limits.

The reactor coolant radioactive iodine concentration is limited to 1.0 uCi/gram by technical specification 3.4.8. Transient conditions that exceed the 1.0 uCi/gram limit are allowed within the time and concentration constraints of the action statements. Transient conditions cannot exceed 1.0 uCi/gram for more than 48 hours during one continuous time interval. Cumulative transient conditions cannot exceed 800 hours in any consecutive 12-month period.

In addition to technical specification 3.4.8, TVA will institute an interim administrative limit of 0.75 uCi/gram. Should this administrative limit be reached, TVA will contact NRC. If TVA cannot justify operating above this limit, the appropriate technical specification action statement will be followed.

TVA will revise plant procedures before the restart of unit 2 to require NRC notification if primary coolant radioactive iodine concentrations exceed 0.75 uCi/gram. The interim limits will be maintained until generic industry actions obviate the need for the interim iodine concentration limits or when other TVA or industry solutions are accepted.

Long-Term Actions

TVA is a member of the WOG. The WOG is considering various programs to apply the EPRI/W/NRC iodine partitioning test results to SGTR dose consequence evaluations. TVA will follow these programs and will apply the accepted industry solutions to SQN.

TVA will also be investigating the benefits of thermal hydraulic modeling to determine the appropriate tube bundle uncovering period. Successful results from this sort of program would be applied to the SGTR dose consequence evaluations to remove gross conservatisms.

Summary

W notified TVA of a potential unreviewed safety question involving the dose consequences of an SGTR event. TVA has evaluated this information and made a preliminary determination that SQN may be affected. In order to facilitate restart, TVA is instituting interim actions that will be completed before the restart of unit 2 to ensure that the consequences of an SGTR event, even with very conservative bounding assumptions, remain within regulatory limits. TVA will maintain the interim actions until generic industry actions obviate the need for interim actions or when other TVA or industry solutions are accepted.

Enclosure 2

SQN SGTR POTENTIAL UNREVIEWED SAFETY QUESTION

Commitments

1. TVA will revise plant procedures before unit 2 restart to incorporate an interim limit of 0.75 uCi/gram. TVA will notify NRC within 48 hours whenever this limit is exceeded to discuss justification for continued operation above the administrative limit. These limits will be maintained until industry actions obviate the need for the limits or when other TVA or industry solutions are accepted.