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MAY 23 1988

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Gentlemen:

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

SEQUOYAH NUCLEAR PLANT (SQN) - NRC INSPECTION REPORT NOS. 50-327/88-24 AND 50-328/88-24 - APPENDIX R

By letter dated April 19, 1988, TVA responded to the referenced inspection report. On May 10, 1988, an enforcement conference was held in Rockville, Maryland, at which TVA presented further information focused, at NRC's request, on the single issue of a postulated fire in the annulus. At the conclusion of the conference, NRC requested that TVA submit information for the record. Indication was also given that enforcement action at Severity Level III was under consideration. TVA maintains that enforcement action is not supported by the facts of this case, least of all enforcement action at an escalated level.

In this letter, TVA provides the technical information requested by the NRC regarding the fire in the annulus issue and demonstrates that safe shutdown was assured at all times for SQN unit 2 (see enclosure). Attachment 1, "Analysis Following Loss of Normal RCS Letdown and Boric Acid Makeup" [PROPRIETARY] and Attachment 2, "Appendix R Reactivity Calculations" [PROPRIETARY], of the enclosure contain information which is proprietary to Westinghouse Electric Corporation. Accordingly, we request that this information be withheld from public disclosure.

In order to not delay this submittal of information to the commission in connection with the review of SQN Appendix R related calculations, we will comply with the requirements of 10 CFR 2.790 to provide proprietary and nonproprietary versions, together with an affidavit, as soon as the proprietary information contained in the submittal has been specifically identified and the proprietary and nonproprietary versions have been prepared. We will submit the required number of copies of the proprietary and nonproprietary versions of the information and required affidavit at that time. In the meantime, we have provided sufficient copies for you to initiate your review. It is our understanding that E. Shomaker, Esq., of the NRC Office of the General Counsel, has advised Westinghouse that he concurs with this procedure. We expect to be able to fully comply with the requirements for the proprietary and nonproprietary versions of the information and an accompanying affidavit within four weeks.

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TVA'S POSITION

TVA's position regarding the cable-to-cable interactions issue was stated in the April 19, 1988 letter and reemphasized in the enforcement conference. TVA maintains that a method was proposed by SQN that was technically sound and considered by past NRC review to be satisfactory. On the basis of statements made by NRC in the May 10, 1988 enforcement conference, it is TVA's understanding that, while NRC does not consider a change in NRC staff position to have occurred, the interactions specifically reviewed and accepted previously by NRC will not be cited as examples of the alleged violation. The remaining item under consideration for enforcement action concerns the adequacy of TVA's shutdown analysis for a postulated fire in the annulus of SQN unit 2. In particular, NRC stated its position that enforcement would be based on the asserted inadequacy of the TVA analysis at the time of the March 1988 inspection. With regard to this remaining item, it is TVA's position that:

- Questions concerning TVA's analysis of the annulus fire should have been treated as an unresolved item to be resolved on a technical basis following the inspection.

- NRC interpretation of section III.G.2 of Appendix R with respect to cable interactions (including spurious actuations and high-low pressure interfaces) has evolved since 1981 and has not been consistent in all cases.

- Even if enforcement action is determined to be appropriate in this case, application of the NRC Enforcement Policy results in no greater than a Severity Level IV violation.

As indicated during the recent SQN Appendix R enforcement conference, NRC provisionally agreed that public health and safety were never in question for SQN unit 2, pending NRC review of the TVA analyses. The remainder of this letter sets forth TVA's position regarding enforcement action.

TREATMENT AS AN UNRESOLVED ITEM

A. Generic Letter (GL) 86-10 Guidance

GL 86-10 (page 3, section C) discusses fire protection documentation requirements.

> The NRC intends to initiate enforcement action where, for a given fire area, compliance with Appendix R is not readily demonstrable and the licensee does not have available a written fire hazard analysis for the area. (emphasis added)

Indeed, the Commission's statement in the letter suggests that no enforcement action at all should be taken for the annulus fire issue at SQN. TVA performed a comprehensive Appendix R evaluation of SQN in 1984, including development of a shutdown model, tracing of safe shutdown and associated circuit electrical cabling, and development of documentation demonstrating how Appendix R was satisfied for each area. Additionally, other supporting calculations and evaluations were performed for specific Appendix R-related issues, including the reactivity issue caused by a fire in the annulus. Thus, TVA had the documentation called for in GL 86-10, paragraph C. Before the March 1988 inspection, TVA had identified a potential deficiency in the 1987 analysis and was in the process of resolving this deficiency at the time of the inspection by performing confirmatory analyses, the details of which are provided in the enclosure.

Not all potential deficiencies or nonconformances are reportable or constitute violations of regulations or the license. It is important to evaluate identified deficiencies/nonconformances to determine reportability as well as whether the condition is outside the licensing basis of the plant. Key to this determination is the operability of components or systems as a result of the condition, i.e., safety significance.

The identification of a deficiency does not automatically indicate inoperability or noncompliance with regulatory requirements; the deficiency must be evaluated to reach this determination. TVA has performed reviews for the annulus fire issue and did not reach a point where a violation involving equipment operability or regulatory requirements existed. TVA's initial determination in this respect has been confirmed by the recently completed analyses contained in the enclosure.

Clearly, SQN is not in the situation described in GL 86-10; TVA had evaluated and performed area analyses that were available at the time of the inspection. This analysis showed that letdown was not required to achieve and maintain safe shutdown, and the questions raised concerning the analysis did not revise the analysis results. The issue is not whether TVA had performed and documented the Appendix R evaluation, but whether a potential deficiency in a certain calculation assumption automatically equates to a violation of 10 CFR 50, Appendix R.

B. Unresolved Item Examples

Numerous examples exist where documentation questions were raised in NRC inspections of Appendix R programs and were designated as unresolved items. This treatment is also consistent with the NRC Inspection and Enforcement Manual, Chapter 0400, "Enforcement Program," which defines an unresolved item as, "If sufficient information does not exist to determine if a violation of a requirement occurred, the item may be identified as an unresolved item in an inspection report." A few examples of Appendix R, documentation-related unresolved items are:

- Fort Calhoun, July 1, 1983: The licensee had not considered the potential affect of spurious opening of an auxiliary feedwater (AFW) recirculation valve on the ability of the AFW pump to perform its postfire shutdown functions. Pending the licensee's review, this was considered an open item.

- Trojan, August 31, 1983:

  The inspection report noted that a documented high-low pressure interface analysis had not been performed and that a documented analysis of the effects of spurious signals on safe shutdown had also not been performed. This item was indicated as not being an item of noncompliance or a deviation and would be verified once a complete analysis has been performed.

  The licensee's calculation for shutdown with loss of service water pumps was questioned by the inspection team. The calculation assumed that both fire pumps would be available; however, a fire in the intake structure could cause loss of one fire pump in addition to loss of all three service water pumps. This was left as an open item pending completion of a licensee reanalysis.

- Fort St. Vrain, March 16, 1984: No spurious signal or common enclosure associated circuit analysis had been performed. This was designated as an unresolved item.

- Davis Besse, August 30, 1984: The inspection report noted that the licensee had not addressed the issue of pressure control while maintaining hot standby for a fire at the alternate shutdown panel. This was carried as an unresolved item in the inspection and not a violation or noncompliance.

- Palisades, November 14, 1986:

  The licensee had not performed a breaker coordination study for non-safe-shutdown circuit on a common power source with safe shutdown equipment. The licensee committed to complete the analysis within approximately one year. This was an unresolved item.

  During the inspection, the NRC requested technical justification for certain systems (heating, ventilating, and air conditioning [HVAC], seal cooling, heat tracing) not protected as safe shutdown systems. The licensee committed to provide documented analyses to the NRC after the inspection. This was an unresolved item.

- Pilgrim, June 18, 1987: The NRC inspection team had difficulty in following the licensee's documented Appendix R analysis. The licensee committed to prepare a document to more clearly describe the detailed analysis. This was designated as an unresolved item.

- Arkansas Nuclear One (ANO), units 1 and 2, September 30, 1987:

  The licensee had not performed an analysis to demonstrate that safe shutdown could be achieved without protecting the HVAC systems to meet Appendix R. This was designated as an open item pending completion of ventilation analyses. This was an unresolved item.

  During the inspection, the licensee failed to provide marked-up drawings to demonstrate routing of electrical cables. The documentation apparently existed, but the licensee failed to present the requested information during the inspection. Cable separation routing was designated as an unresolved item.

  Several high-low pressure interfaces were found to not have adequate interface protection, including certain ones that were found to be unprotected for shorts and hot shorts in several areas. This was an unresolved item.

  During the inspection, the licensee indicated that documented qualification test reports were not available for three different fire barrier penetration seal designs. This was an unresolved item.

- Salem unit 2, January 26, 1988:

  The licensee did not have fire test documentation to demonstrate the adequacy (fire rating) of fire barrier penetration seals. This was cited as an unresolved item.

  The licensee relied on use of pneumatic jumpers to prevent spurious operation of valves in achieving hot shutdown. The licensee pointed out that this had previously been specifically reviewed and accepted by the NRC. The inspectors felt this was a repair and thus not allowed for hot shutdown. This was cited as an unresolved item.

These examples identify numerous cases where documentation deficiencies were not designated as violations, but rather as unresolved items. Several of these are items more significant than the subject TVA item in that many examples are cases where an analysis of a particular issue or area was not performed. As noted before, TVA had performed an analysis. Designation of the SQN issue as an unresolved item would be consistent with GL 86-10, other regulatory precedents, and regulatory requirements on the identification and disposition of nonconforming items.

ENFORCEMENT ACTION

TVA maintains its position, stated in the April 19, 1988 letter, that previous NRC review and approval of TVA methodology for dispositioning certain cable interactions renders enforcement action inappropriate in this case. A meaningful enforcement policy is not well served by the imposition of

sanctions based upon the disagreement of one inspection team with the findings of three prior inspection teams reviewing the same issues. This is especially true when the technical basis for the alleged violation lies in a regulatory area not specifically addressed by the applicable regulation, 10 CFR Part 50, Appendix R, and where NRC guidance has evolved throughout the period of Appendix R implementation and NRC inspections.

Should NRC determine, however, that enforcement action will be taken for the single issue of fire in the annulus, it is clear that the violation should be classified, at the very worst, no higher than Severity Level IV under the Commission's current enforcement policy, 10 CFR Part 2, Appendix C, revised September 28, 1987. TVA has shown conclusively that an incorrect engineering judgement used in support of a 1987 safe shutdown analysis would have had no impact on safe operation of SQN unit 2 even using extreme assumptions (see enclosure). Moreover, the 1987 analysis deficiency (and thus the alleged violation based on this analysis deficiency) represents a single, non-safety-significant deficiency in an extensive fire protection program.

TVA addresses the basis for this position in more detail below.

A. Inconsistent Staff Interpretations of Circuit Failure Modes Required to be Addressed in the Fire Hazards Analysis

1. Appendix R and Initial Safe Shutdown Guidance

Appendix R became effective on February 17, 1981*. Section III.G.2 requires protection of circuits needed to operate safe shutdown equipment in the event of a fire and associated nonsafety circuits, wherever fire damage to those circuits ". . . could prevent operation of cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions . . . ."

Three days after the effective date of Appendix R, GL 81-12 was issued to clarify the meaning of this provision. With respect to this letter, the following should be noted:

- Section 4 of the "Staff Position" states that reactivity control for pressurized water reactor (PWR) hot standby includes a "letdown system <u>if required</u>." (emphasis added) **

* Although Appendix R does not apply by its terms to SQN unit 2, the unit 2 license required compliance with specific sections of Appendix R.

** TVA's basis for achieving and maintaining safe shutdown without letdown is set forth in enclosure 1. Examples are also provided of NRC acceptance of this approach on other facilities.

- Cable interactions and high-low pressure interfaces are discussed in Enclosure 2 to GL 81-12--but only in connection with the application of Section III.G.3 on alternative shutdown.

On April 7, 1982, a "clarification" of GL 81-12 was issued, which stated the following in regard to associated circuits:

> It is important to note that our interest is only with those circuit [sic] (cables) whose fire-induced failure could affect shutdown. The guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits are not requirements. These guidelines should be used as guidance only when needed. These guidelines do not limit the alternatives available to the licensee for protecting the shutdown capability. All proposed methods . . . will be evaluated by the staff for acceptability.

2. Fitzpatrick Exemption

In November 1982, the Power Authority of the State of New York (PASNY) requested an exemption "for 3 Phase AC and DC Power Circuits" (Fitzpatrick docket, November 22, 1982). This exemption was requested on a generic basis for application "to the Authority's entire (Appendix R) reevaluation." PASNY had made clear in an earlier Fitzpatrick submittal dated February 26, 1982, that, while it had identified multiple spurious actuations at high-low pressure interfaces, it considered 3-phase, alternating-current (ac) and 2-wire, direct-current (dc) power circuit "reconnection" failures to be incredible. However, PASNY believed that 2-wire dc control circuit reconnection failures were credible and thus would be evaluated for spurious actuation potential.

The NRC granted the requested methodological exemption--with no exception for high-low pressure interfaces--in April 1983 (48 FR 19963). The staff accepted the licensee's argument that circuit failure modes of these two types (3-phase ac and 2-wire dc power circuits) were not "considered credible." This exemption was described to the Commission in SECY-83-269 (July 5, 1983; pages A-2, -3).

3. Generic Letters 85-01 and 86-10

Nearly two years after the Fitzpatrick exemption was issued, the staff released GL 85-01 (issued January 9, 1985). In section 5.3 of the "Questions and Answers," safe shutdown issues are covered. Question 5.3.1 reads, "What circuit failure modes must be considered in identifying circuits associated by spurious actuation?" The two-sentence response reiterates sections III.G.2 and III.L 7 of Appendix R and notes that circuit failure modes "could be bypassed by assuming all possible failure states for the equipment. . . ."

The staff position regarding 3-phase ac and 2-wire dc power circuit shorts established in the Fitzpatrick exemption is not included. In the response to Question 5.3.10 regarding assumed plant transients, the staff restates its position that simultaneous spurious actuations must be addressed for high-low pressure interface actuations. As in GL 81-12, however, this position is established for alternative shutdown under section III.L.7.

The latest staff guidance document, GL 86-10, reexamines these issues in the response to Question 5.3.1 (the same question as answered in GL 85-01). This response attempts to fit together the various pieces described above. First, section III.G.2 is cited in connection with the high-low pressure interface issue. Second, the "Fitzpatrick doctrine" is acknowledged for 3-phase ac and dc ungrounded shorts but, as to the latter, is apparently extended beyond power circuits to control circuits as well. Third, the "Fitzpatrick doctrine" is disallowed entirely for high-low pressure interfaces without any explanation of the technical or regulatory basis for this position.

4. Other Examples of Inconsistent Interpretation

It is clear from the above that, throughout the period 1981-1986 and probably beyond, staff interpretation of the circuit failure requirements of sections III.G.2 and III.L.7 has undergone a steady, and sometimes inconsistent, evolution. Examples of inconsistency later than the Fitzpatrick exemption can easily be located.

- Comanche Peak Safety Evaluation Report (SER)

  In a Supplemental Safety Evaluation Report (SSER) issued to Comanche Peak in 1985 (SSER No. 12, October 1985), the staff approved the licensee's disposition of a residual heat removal (RHR) shutdown isolation valve interaction (high-low pressure interface) as follows:

  > Power for the RHR shutdown isolation valves has been removed at the circuit breaker; therefore, spurious operation as a result of fire damage of control cables is not possible. Because the valves are powered by 3-phase 480-V ac, spurious operation as a result of fire-damaged power cables between the circuit breaker and the valve motor is not considered credible. (page 9-9; emphasis added)

This SSER was written while GL 86-10 was in preparation--yet it is clearly inconsistent with the staff response to Question 5.3.1 in that it allows disposition of a high-low pressure interface on the grounds that a 3-phase short "is not considered credible." It is, however, consistent with the Fitzpatrick exemption.

- Haddam Neck Exemption

  In an exemption issued to the Haddam Neck plant in 1984 (49 FR 46516; November 26, 1984), the staff approved deviation from section III.G.2 separation requirements for the control room on the theory that a fire would damage at most two adjacent control panels before being extinguished. Thus, the licensee had to address circuits, including spurious operation, only by analyzing two adjacent panels at a time. No mention is made of high-low pressure interfaces, though it is obvious that a fire in the control room involves circuits for all such plant interfaces. If the concern regarding such interfaces is based on risk, some additional requirements might be imposed if two adjacent panels contained circuits that, if both were involved in a fire, could spuriously open a high-low pressure interface. The exemption imposed no such additional review requirement.

5. Summary

This detailed review of staff positions on circuit failure modes has been undertaken to demonstrate that these positions have evolved gradually, and not always consistently, during the period 1981-1986. It was during this same period that SQN unit 2 sought to implement the backfit provisions of Appendix R and was reviewed by three staff inspections. It should not be surprising that these previous inspection teams found TVA's disposition of cable interactions acceptable, considering that (1) it is a technically sound approach, and (2) "staff positions" were neither solidified nor supported by a clearly expressed technical or regulatory basis. TVA was therefore fully justified in concluding that its approach to cable interactions constituted another method proposed by the licensee and was considered by the staff on its own merit and was found to be satisfactory (reference GL 86-10).

TVA does not dismiss the views of the March 1988 inspection team on technical grounds and in fact agreed with the inspection team that provision of assured letdown for a fire in the annulus was a superior technical resolution. Other inspection team findings are under TVA review for long-term technical resolution; but while the inspection team was clearly entitled to reach its own technical judgments in this area of Appendix R, the unsuitability of this case for enforcement action--particularly at an escalated level--should be clear upon objective review of the facts.

B. Application of Enforcement Policy

1. 10 CFR Part 2, Appendix C

Statements made by NRC during the enforcement conference suggested that a Level III violation was being considered for the fire in the annulus issue. Given the facts in this case, particularly at this level, enforcement action would directly contravene the Commission's enforcement policy contained in 10 CFR Part 2, Appendix C, revised September 28, 1987. Given a reading of the facts least favorable to TVA, no more than a Severity Level IV violation can be found.

The Commission generally characterizes violations below Level II as follows:

> Severity Level III violations are cause for significant concern. Severity Level IV violations are less serious but are of more than minor concern; i.e., if left uncorrected, they could lead to a more serious concern. Severity Level V violations are of minor safety or environmental concern.

As TVA demonstrated at the May 10, 1988 enforcement conference and as verified by the enclosure to this letter, the incorrect depressurization rate assumption in the 1987 peak Xenon analysis did not create a significant safety concern. In fact, safe shutdown could have been achieved using the least favorable combination of operational events and assuming that operators did not follow prescribed maximum-boration procedures. Thus, had the problem gone uncorrected, even if this conclusion is disputed and NRC concludes that the analysis error might have led to a more serious safety concern, a Severity Level IV violation at most would be called for.

These conclusions are supported by application of the Commission's "Reactor Operations" guidance in Supplement I of the enforcement policy. The examples most apropos are those involving 10 CFR 50.59 because the alleged violation involves a written analysis as opposed to an operational event. A Level III violation is suggested where the licensee has "(Failed) to meet the requirements of 10 CFR 50.59 such that a required license amendment was not sought." This implies that the licensee modified the facility in such a way that an unreviewed safety question was raised or a technical specification violated without performing the appropriate analysis and requesting a license amendment. With respect to the SQN annulus fire issue, this would have been equivalent to failure to perform a fire hazards analysis for the area at all or to have performed only the most cursory analysis.

To the contrary, TVA performed a detailed documented analysis addressing the annulus fire issue in 1984 and 1987. While the latter calculation was found (following SQN shutdown) to contain an incorrect assumption, which ultimately did not negate the conclusion of the 1987

calculation (i.e., safe shutdown could be achieved and maintained), both analyses were adequate to demonstrate shutdown capability. In terms of 10 CFR 50.59, this would be similar to having performed two reviews of a single plant modification, the second of which was incorrect in some respect not significantly affecting safety or outcome of the 10 CFR 50.59 evaluation. This set of facts would fall under the Severity Level IV example of 50.59 deficiencies. Such deficiencies, to be less than Severity Level III, would involve an error in a 50.59 analysis that would not have affected the overall assessment of the potential for an unreviewed safety question or technical specification violation. That is, correction of the analysis would lead to the same conclusion. In this case, TVA has shown that correction of the 1987 analysis leads to the same conclusion reached based on that analysis--that achieving and maintaining safe shutdown in the event of an annulus fire were, at all times, assured.

2. Fire Protection Escalated Enforcement Precedent

A review of previous Appendix R violations issued by the Commission demonstrates that Severity Level III has been assigned for programmatic and hardware deficiencies far more serious than the SQN annulus fire analysis issue. A few examples are:

- Trojan, September 29, 1983: failure to provide adequate separation of RHR pumps; failure to protect redundant cabling at containment penetrations; failure to provide adequate monitoring instrumentation for alternative shutdown; and inadequate lube oil collection system.

- Susquehanna, June 15, 1987: no automatic suppression system to protect RHR pumps; inadequate separation of cable raceways in the containment access area; redundant shutdown trains not adequately separate in the Equipment Removal Room; and inadequate emergency lighting system.

- Peach Bottom, July 29, 1987: "numerous instances" of failure to separate redundant safe shutdown equipment and cables; and "apparent lack of management attention."

- Surry, July 15, 1987: power and control cables for diesel generators not adequately separated, causing loss of reactor coolant makeup capability for both units if offsite power were lost in a fire.

- Salem unit 2, March 24, 1988: "numerous instances" of failure to separate redundant safe shutdown equipment and cables; and "multiple examples of these significant violations."

U.S. Nuclear Regulatory Commission

MAY 23 1988

Summary

All of these cases, and others that could be cited, involve fire protection deficiencies that exceed in both number and potential safety impact, the single issue of the annulus fire at SQN and, within that issue, the single deficiency in the 1987 calculation.

CONCLUSION

Application of the Commission's general Severity Level guidance, the specific enforcement policy guidance applicable to reactor operations, the discussion of documentation requirements in GL 86-10, and Appendix R enforcement precedents result in the same consistent conclusion: enforcement action is not warranted in this case. No regulatory purpose is served by finding a violation based upon a licensee-identified calculational deficiency not affecting plant safety, promptly addressed upon identification, and representing a very small aspect of a fire protection program found to be in compliance with regulatory standards in all major respects.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R Gridley

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Enclosure
cc (Enclosure): See page 13

U.S. Nuclear Regulatory Commission

MAY 23 1988

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May 10, 1988 Enforcement Conference

STATEMENT OF THE ISSUE

The focus of TVA's presentation made during the May 10, 1988 enforcement conference centered on the annulus fire issue. Simply stated, the scenario is as follows: A fire occurs in the annulus requiring safe shutdown of the plant. The fire damages or otherwise renders inoperable reactor coolant system (RCS) letdown path equipment. The plant must then be borated to a safe shutdown condition to prevent return to criticality. Because SQN unit 2 did not have a protected letdown path before the inspection, NRC questioned SQN's past capability to have been able to borate the RCS to achieve and maintain a safe shutdown condition. Accordingly, NRC considered that TVA had failed to identify the letdown interaction. TVA had not identified this as an interaction because SQN's safe shutdown logic did not require a letdown path to achieve and maintain safe shutdown. It is TVA's position that, at all times before the March 1988 inspection, safe shutdown could have been achieved and maintained given a fire in the annulus.

ORIGINAL ANALYSIS

Before discussing the basis for this position, it is important to review the documented analyses that were in place before the March inspection. The initial Appendix R analysis was conducted as part of the SQN 1984/1985 Appendix R reevaluation effort and was the analysis of record through the time of the SQN shutdown (August 1985). The analysis assumptions included 100-percent power, equilibrium Xenon, and consideration of beginning, middle, and end of core life. The results of this analysis showed that sufficient boron could be added to the RCS to maintain hot standby conditions indefinitely. Establishment of a letdown path was not required to add this boron to the system. Hot standby was achieved through reactor trip, boration to offset Xenon decay and moderator temperature coefficient, makeup provided by the charging pumps, heat removal from the steam generators, and in the longer term passive heat loss from the pressurizer.

Because the analysis was conducted for a specific core cycle (unit 1 cycle 3), the recommendation was made that a letdown path be established so as to avoid reanalysis for each fuel cycle. System Operating Instruction (SOI) 26.3 was developed to establish this letdown path using the RHR system if the plant was to be taken to cold shutdown (CSD). A copy of this analysis is provided in attachment 1.

The use of equilibrium Xenon in the analysis is a reasonable assumption, consistent with other fundamental assumptions used in Appendix R evaluations such as normal operation, 100-percent power, and all equipment initially available for service. Additionally, it should be noted that the basis for SQN Technical Specification 3/4.1.2, "Boration Systems," states, "the maximum expected boration capability requirement occurs at 'end of life' from full power equilibrium Xenon conditions . . ." This is the basis for the

reactivity control system, establishing the initial conditions for all design basis accidents. It would not be reasonable to require Appendix R design/analysis to exceed that capability required to mitigate design basis accidents. In summary, the equilibrium Xenon calculation provided a representative analysis, it was the documented analysis in place through the SQN shutdown, and it showed that a letdown path would not have been needed to achieve safe shutdown.

1987 ANALYSIS

Well after the SQN shutdown, a second analysis was undertaken assuming peak Xenon for the initial condition. The condition was postulated to result from a fast restart. While certainly more limiting than the previous 1984 analysis, this would amount to utilization of a low probability and physically implausible transient condition as the initiation point for the Appendix R analysis. Initial conditions were chosen to minimize boron concentration in the core. The condition starts with a reactor trip from full power with equilibrium Xenon, completion of posttrip review, a management decision to restart within 2-3 hours of the trip, maximum dilution rate initiated to counter Xenon buildin, and a step power increase from 0- to 100-percent power coincident with Xenon peaking and control rods at maximum insertion rate. An immediate reactor trip is then postulated to occur under these conditions, thereby resulting in 0-percent reactor power coincident with peak Xenon and minimum boron concentration. A fire is then assumed to occur at these conditions.

Initial evaluation of this peak Xenon case indicated that safe shutdown could still be achieved; and, so as to conservatively resolve all questions, the 1987 Appendix R analysis was performed using peak Xenon. In addition to the initial conditions described above, consideration of beginning, middle, and end of core life and a depressurization to permit RHR cut-in in approximately 16 hours following reactor trip was also assumed. A copy of this 1987 analysis is provided in attachment 2.

Following the March 9, 1988 public meeting (held to address Appendix R related issues) and before the March 14, 1988 inspection, questions were raised by TVA regarding the validity of the depressurization rate used in the 1987 analysis. These questions were in the process of being addressed at the time of the March inspection, specifically to determine if any of the questions might affect the validity of associated shutdown capability.

1988 POSTINSPECTION ANALYSIS

At this point, TVA had not determined that shutdown capability was affected (by the questions) but rather initiated studies to verify that it was not. As previously discussed, TVA considered the equilibrium Xenon analysis to be representative of realistic shutdown scenarios and verified that the questions raised concerning the peak Xenon analysis did not impact the validity of the equilibrium Xenon analysis results. This provided a high level of confidence that safety during operation was not at issue regardless of the outcome regarding the depressurization rate questions. However, to fully evaluate the

more severe postulated conditions, TVA analyzed two peak Xenon cases to verify that, even assuming an unrealistic peak Xenon initial condition, safe shutdown capability was maintained in spite of the incorrect depressurization rate input to the analysis.

20,000-Parts-per-million (ppm) Boron Case

The first case involved evaluation of the response of both equipment and operators that would have occurred if a fire in the annulus rendered letdown paths inoperable. TVA verified that hot standby was still achievable based on the following: SOI-26.2 called for use of maximum boration of 20,000-ppm boron using the boric acid tank; although the 1987 analysis had assumed 2,000 ppm, the instruction clearly would have directed the operators to initiate maximum boration. TVA verified that this boric acid system, which is in the Auxiliary Building, would have been unaffected by the fire in the annulus. It was determined that less than 2,000 gallons of 20,000-ppm boron would be adequate to achieve hot standby; and 12,000 gallons of volume in the RCS was available because of "shrink" resulting from the cooldown (547 to 350 degrees Fahrenheit). A conservative boration flow rate of one gallon per minute (gal/min) was assumed. It should be noted that required boration volume and flow rate were determined by final calculation to be even smaller than cited in the enforcement conference, i.e., 2,000 versus 6,000 gallons, one gal/min versus 20 gal/min. As a result, it was again shown that no letdown was required to achieve and maintain safe shutdown. It should be noted that CSD could be achieved in the longer term through passive heat loss from the pressurizer, dropping pressure down to RHR "cut-in." The supporting analysis for this case is provided in attachment 2 with input from attachments 3 and 4. Verification of this case ensured that, even above and beyond the more representative equilibrium Xenon case, safe shutdown capability had always been provided.

2,000-ppm Boron Case

The second peak Xenon case evaluated went one step further than the previous case. TVA verified that, using the same assumptions from the 1987 analysis (designated shutdown equipment and 2,000-ppm boron), safe shutdown could still have been achieved and maintained. TVA verified that hot standby was achievable through boration to replace RCS shrink volume using a boration path provided through reactor coolant pump seal flow and safety valve relief. Boration to CSD also would have been achievable in the longer term. The supporting analysis for this case is provided in attachment 2 with input from attachments 3 and 4.

OTHER PLANT EXAMPLES

Although this information was not presented at the enforcement conference, other PWR plants had similarly determined that a letdown path is not required to allow adequate boration for safe shutdown. For example:

- ANO, units 1 and 2:

  - ANO-1 isolates all letdown paths for postfire safe shutdown. The licensee determined that adequate boration for cooldown and Xenon decay can be provided using high-pressure injection pumps from the borated water storage tank (2,270 ppm) to offset RCS inventory shrinkage (reference NRC Inspection Report 50-313/87-14, 50-368/87-14, September 30. 1987).

  - ANO-2 isolates all letdown paths for postfire shutdown. The licensee determined that adequate boration can be provided using the charging pumps taking suction from the boric acid makeup tanks (8,750 ppm) or from the refueling water storage tank (1,731 ppm) to offset RCS inventory shrinkage (reference NRC Inspection Report 50-313/87-14, 50-368/87-14, September 30, 1987).

- Point Beach, units 1 and 2: The licensee analysis isolates normal and excess letdown paths. The required shutdown margin is maintained by the addition of water from the refueling water storage tank (2,000 ppm) using the chemical and volume control system thereby offsetting RCS volume shrinkage (reference NRC Inspection Report 50-266/87007, 50-301/87007, July 7, 1987).

It should be noted that these inspections did not raise any issues with the licensee's method of accomplishing this safety function.

SUMMARY

For the three previously described cases--(1) equilibrium Xenon, (2) peak Xenon using real-life response (20,000 ppm), and (3) peak Xenon using the 1987 analysis assumptions (2,000 ppm)--TVA has verified that the depressurization rate calculation did not alter the validity of previous analysis results in demonstrating the ability to achieve and maintain safe shutdown.

Two options were examined by TVA at the time of the audit to resolve the annulus fire issue: (1) further analysis and possible procedure changes, or (2) possible hardware upgrade to ensure letdown. Upon evaluation of these two options, it was determined that, to expedite restart of SQN unit 2 and to simplify postfire operator actions, the hardware option was preferable. The actions were prompt--the inspection took place March 14-18, 1988; and the modification was implemented and inspected by NRC on March 23, 1988. It should be noted that the modification involved addition of approximately 10 sprinklers to approximately 7,000.

TVA later determined that technical resolution could have been achieved without plant modification. However, TVA maintains the decision made at the time was appropriate considering the need to expedite resolution for restart; the timeframe involved in reaching technical and regulatory resolution with NRC staff; and the relative simplicity in effecting a quick, conservative resolution through the modification. While TVA understands this has been a complicated technical and regulatory issue, enforcement action is not warranted.

Attachment 1

Analysis Following Loss of Normal
RCS Letdown and Boric Acid Makeup

(1984 Equilibrium Xenon Analysis)
(S56 880511 605)

NOTE: THE ATTACHED CALCULATION AS MARKED SHOULD BE TREATED AS WESTINGHOUSE PROPRIETARY INFORMATION.

Attachment 2

Appendix R Reactivity Calculations

- 1987 Analysis
- 2,000-ppm Boron Analysis
- 20,000-ppm Boron Analysis

(L32 880516 902)

NOTE: THE ATTACHED CALCULATION AS MARKED SHOULD BE TREATED AS WESTINGHOUSE PROPRIETARY INFORMATION.

Attachment 3

Reactor Coolant Pump Seal Injection for Appendix R Boration Requirements

(Input Analysis for the Reactivity Calculation Using 2,000- and 20,000-ppm Boron)

(B45 880519 235)

Attachment 4

Determination of Flow Rate Into the RCS Via the
Reactor Coolant Pump Seal Injection System
During an Appendix R Event

(Analysis Supporting Attachment 3)