TENNESSEE VALLEY AUTHORITY

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FEB 03 1987

10 CFR 50.12

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. B. J. Youngblood

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

SEQUOYAH NUCLEAR PLANT - CONTAINMENT ISOLATION SYSTEM - EXEMPTION FROM 10 CFR 50, APPENDIX A, GENERAL DESIGN CRITERIA 55 AND 56 - RHR SUPPLY LINE TO LOOP 1 AND 2 HOT LEGS AND VACUUM RELIEF LINES

IE Inspection Report Numbers 50-327/86-20 and 50-328/86-20, transmitted from J. A. Olshinski to S. A. White by letter dated April 23, 1986, identified unresolved items 50-327/86-20-09 and 50-328/86-20-09, Containment Isolation Design pertaining to the Chemical and Volume Control System. As TVA moved to close out these unresolved items, NRC requested additional information and detail concerning Sequoyah's containment isolation system design. Our letter dated January 2, 1987 summarized our understanding of the containment isolation system design issues raised by NRC and provided a detailed response to those issues, as well as providing a chronology of related submittals, meetings, and telephone calls held with NRC, and a list of commitments to be taken by TVA to close out remaining open issues known to TVA at the time the submittal was made. Two of the issues identified and considered closed out in that submittal involved the designs of residual heat removal (RHR) supply line to loop 1 and 3 hot legs and containment vacuum relief penetrations.

TVA has designated the remote manual valve in the RHR pump supply to the loop 1 and 3 hot legs as a containment isolation valve. This RHR supply line has redundant isolation provisions; a remote manual valve and two missile-protected check valves inside containment, and a closed system outside containment. These redundant isolation provisions provide assurance that no single failure could result in release of containment atmosphere to the environment.

Containment isolation for the vacuum relief penetrations is provided for by two outboard isolation valves located in series and attached to penetration sleeves extending from the containment shell. The outboard isolation valve is a spring-loaded check valve. The inboard isolation valve is ar air-power-operated butterfly valve that is bolted directly to the containment penetration sleeve, is operated by two solenoid actuators, and is powered by

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redundant air supplies. This redundant actuator and power supply configuration provides assurance that no single failure of either an actuator or power supply could result in release of containment atmosphere to the environment.

As was stated in our January 2, 1987 submittal, it is the opinion of the TVA staff and management that the redundant isolation provisions provided for in the RHR pump supply line to hot legs 1 and 3 and the containment vacuum relief penetrations ensure the protection of the health and safety of the public, and that these isolation designs are acceptable under the provisions of "other defined bases" as allowed by 10 CFR 50, Appendix A, General Design Criteria (GDC) 55 and 56. However, on January 20, 1987, during a telephone call held between NRC and TVA management, TVA was notified that a request for exemption from the requirements of 10 CFR 50, Appendix A, GDC 55 and 56, for both the RHR supply line to loop 1 and 3 hot legs and the containment vacuum relief lines, respectively, was required for NRC to continue its legal review of Sequoyah's containment isolation design.

This submittal transmits the subject requests for exemptions from the requirements of 10 CFR 50, Appendix A, GDC 55, for the RHR supply line to loop 1 and 3 hot legs and 10 CFR 50, Appendix A, GDC 56, for the containment vacuum relief lines. To support the subject exemption requests, a brief description of the design features of both the RHR supply line to loop 1 and 3 hot legs and the containment vacuum relief lines that prevent the escape of containment atmosphere, a discussion of the logic behind the failure position of the containment vacuum relief butterfly valves, and a discussion of the applicable basis for requesting exemptions from the requirements of 10 CFR 50, Appendix A, GDC 55 and GDC 56, under the criteria of 10 CFR 50.12 are also provided. Please review this exemption request and advise us in writing of your determination.

Enclosed is a check for the $150 application fee required by 10 CFR 170.12 for the review of our exemption request.

Please direct questions concerning this request to Timothy S. Andreychek at (615) 870-7470.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. A. Domer

J. A. Domer, Assistant Director
Nuclear Safety and Licensing

Sworn to and subscribed before me
this 3rd day of Feb 1987.

Susan C Parker
Notary Public
My Commission Expires 2/7/90

Enclosures
cc: See page 3

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ENCLOSURE

REQUEST FOR EXEMPTION FROM THE REQUIREMENTS OF 10 CFR 50 APPENDIX A GENERAL DESIGN CRITERIA 55 AND 56 FOR THE RESIDUAL HEAT REMOVAL SUPPLY LINE TO LOOP 1 AND 3 HOT LEGS AND CONTAINMENT VACUUM RELIEF LINES

BACKGROUND

IE Inspection Report Numbers 50-327/86-20 and 50-328/86-20, transmitted from J. A. Olshinski to S. A. White by letter dated April 23, 1986, identified unresolved items 50-327/86-20-09 and 50-328/86-20-09, Containment Isolation Design pertaining to the Chemical and Volume Control System. As TVA moved to close out these unresolved items, NRC requested additional information and detail concerning the containment isolation system design for the Sequoyah Nuclear Plant (SQN). Our letter dated January 2, 1987 summarized our understanding of the containment isolation system design issues raised by NRC and provided a detailed response to those issues, as well as providing a chronology of related submittals and meetings and telephone calls held with NRC, and a list of commitments to be taken by TVA to close out remaining open issues known to TVA at the time the submittal was made. Two of the issues identified and considered closed out in that submittal involved the designs of residual heat removal (RHR) supply line to loop 1 and 3 hot legs and containment vacuum relief penetrations.

TVA has designated the remote manual valve in the RHR pump supply to the loop 1 and 3 hot legs as a containment isolation valve. This RHR supply line has redundant isolation provisions; a remote manual valve and two missile-protected check valves inside containment, and a closed system outside containment. These redundant isolation provisions provide assurance that no single failure could result in release of containment atmosphere to the environment.

Containment isolation for the vacuum relief penetrations is provided for by two outboard isolation valves located in series and attached to penetration sleeves extending from the containment shell. The outboard isolation valve is a spring-loaded check valve. The inboard isolation valve is an air-power-operated butterfly valve that is bolted directly to the containment penetration sleeve, is operated by two solenoid actuators, and is powered by redundant air supplies. This redundant actuator and power supply configuration provides assurance that no single failure of either an actuator or power supply could result in release of containment atmosphere to the environment.

All valves now designated as containment isolation valves and all associated piping have been purchased to TVA Class B requirements. TVA Class B designation means the valves and piping are ASME Section III Class 2, Seismic Category I or equivalent. Valves and piping procured before April 1973 are designed in accordance with ANSI Standard B 16.5 and B 31.1, respectively, as opposed to Section III of the ASME Code.

All valves now designated as containment isolation valves are protected from both internal and external missiles, pipe whip, or jet impingment that may result from a postulated Loss-of-Coolant Accident (LOCA).

As was stated in our January 2, 1987 submittal, it is the opinion of the TVA staff and management that the redundant isolation provisions provided for in the RHR pump supply line to hot legs 1 and 3 and the containment vacuum relief penetrations ensure the protection of the health and safety of the public, and that these isolation designs are acceptable under the provisions of "other defined bases" as allowed by 10 CFR 50, Appendix A, General Design Criteria (GDC) 55 and 56. However, on January 20, 1987, during a telephone call between NRC and TVA management, TVA was notified that, although the penetration designs were technically adequate, requests for exemptions from the requirements of 10 CFR 50, GDC 55 and 56, for the RHR supply line to loop 1 and 3 hot legs and the containment vacuum relief lines, respectively, were required for NRC to continue its legal review of Sequoyah's containment isolation design. TVA management agreed to submit such exemption requests. A summary of both evaluations made in support of and the basis for requesting the subject exemptions from 10 CFR 50, Appendix A, GDC 55 and 56, follows.

SYSTEMS EVALUATION

A summary of the evaluation of the technical adequacy of the containment isolation scheme for the RHR supply line to loop 1 and 3 hot legs and the containment vacuum relief penetrations follows.

Residual Heat Removal (RHR) Supply Line to Loop 1 and 3 Hot Legs, Penetration X-17

The design features for penetration X-17 at Sequoyah, the RHR pump supply line to the loop 1 and 3 hot legs, consist of primary and secondary (missile protected) check valves on the two primary branch lines inside containment, a remote manual motor-operated valve on the single supply line to the branches inside containment, and a closed seismically qualified, TVA Class B system outside containment. Additionally, inside containment there is a normally closed remote manual valve on a small test line branch off the single supply line and a relief valve on a second branch off the single supply line. This design deviates from the isolation scheme explicitly identified as acceptable in 10 CFR 50, Appendix A, GDC 55, in that the remote manual valve is located inside containment with the outboard barrier provided by the closed system alone. It is TVA's position that this design is acceptable in that redundant isolation barriers are provided in the form of the check valves, the closed safety grade system piping, and capability for remote manual isolation postaccident if the need should arise. No single failure would result in release of containment atmosphere to the environment. TVA has, therefore, redesignated the inboard remote manual valve as an additional containment isolation valve and interprets the design for this penetration as meeting the requirements of 10 CFR 50, Appendix A, GDC 55, on other defined bases.

A review of the applicability of the requirements of 10 CFR 50, Appendix J, leak rate testing was made for the newly designated containment isolation valve. For the injection line penetrations from the low head safety injection pumps (RHR pumps), a water seal is provided postaccident by operation of both RHR pumps with a guaranteed 30-day water supply and an injection pressure greater than 1.1 Pa.

With a single active failure of an RHR pump, the water seal will not be maintained on the associated penetration(s) during the recirculation mode. However, any leakage past the primary and secondary check valves and the remote manual valve would be into a seismically qualified closed system of safety system grade piping. (Both the primary and secondary check valves are leak tested with water as pressure isolation valves to a requirement of less than or equal to 1 gpm at a nominal Reactor Coolant System (RCS) pressure of 2235 psig.)

The piping outside containment meets the requirements for a closed system outside containment as presented in section 6.2.4 of the FSAR. There is testing performed which verifies integrity of this piping. This testing includes annual inspections in accordance with NUREG-0737, position III.D.1.1, in-service pressure testing in accordance with ASME Section XI, and quarterly ASME Section XI pump tests. As the RHR system is a dual purpose system used during normal operation, an additional opportunity is provided to verify system integrity.

Most importantly, these RHR Emergency Core Cooling System (ECCS) injection lines must be available to provide water to the core postaccident to prevent fuel damage. The addition of in-line block valves to permit leak rate testing in accordance with 10 CFR 50, Appendix J would reduce the reliability of these lines to perform their primary safety function following a LOCA.

The combination of a water seal system, a qualified closed system, inspection and testing to verify system integrity, and the need for reliable operation of the RHR ECCS system provides the bases upon which TVA requested an exemption from Type C leak rate testing of the RHR supply penetrations by letter dated December 31, 1986.

Containment Vacuum Relief Penetrations X-111, X-112, X-113

The provision for containment isolation for each of these three penetrations consists of two outboard isolation valves in series attached to penetration sleeves extending from the containment shell. The valve closest to containment is an air-power-operated isolation valve which is actuated by a set of redundant pressure sensors independent of those for other containment isolation valves, and the outer valve is a spring-loaded check valve.

In a conference call held August 21, 1986, between NRC and TVA, NRC expressed concern over the isolation provisions for these penetrations. The apparent concern was the lack of an isolation valve inside containment and consequences of a break in the "piping" outside containment between the isolation valve and containment shell. It was suggested that a demonstration of this "piping" as "superpipe" as designated in SRP section 3.6.2 could serve to resolve NRC concerns. The three vacuum relief lines are required to relieve pressure from the annulus into primary containment in the event of an inadvertent actuation of containment spray (CS) or air return fan operation so as to prevent unacceptable pressure differentials from developing across the containment shell (see FSAR section 6.2.6). Both isolation valves on each penetration are located outside containment to allow the valves to be located as close to containment as possible yet provide reasonable access for maintenance, inspection, and testing.

The first isolation valve outside containment in each line is bolted directly to the containment penetration sleeve. This sleeve is designed and fabricated per the ASME Boiler and Pressure Vessel Code, Section III, Winter 1971 Addenda, subsection NE, and falls under the jurisdictional boundaries of Class MC according to NE-1142. The penetration sleeve between primary containment and the first outer isolation valve is part of the containment vessel. The stress in the penetration sleeve has been evaluated against the ASME section III Class MC allowables and against the stress given in section B.2.b of Branch Technical Position MEB 3-1. The results are provided in table 1 and clearly show that the stresses in the vacuum relief penetration sleeves are well below allowable values.

The spring-loaded check valves, located immediately outboard of the air-power-operated butterfly valves, are designed to be seated when containment pressure is equal to or greater than annulus pressure. These conditions exist under normal operating and postulated LOCA scenarios. As the penetrations are for the relief of a vacuum in the containment, the valves are designed to unseat and allow air to flow into the containment from the annulus <u>only</u> when a sufficient pressure difference exists across the containment to overcome the spring loading of the valves. As stated previously, such pressure differentials may occur in the event of an inadvertent actuation of either CS or air return fan operation.

The butterfly valves in the vacuum relief lines are normally open valves that are designed to fail-open. This design feature was chosen because the valve-open position has been evaluated as providing for the greatest safety for the plant. In the event of an inadvertant actuation of CS or air return fan operation, a failure of the vacuum relief system to perform its intended task could result in the collapse of the containment. Since the valves are normally open, each of the three butterfly valves in the vacuum relief system is provided with two solenoid actuators powered from redundant air supplies. Thus, the valves are single failure proof to closing when required except for a mechanical failure in the butterfly valve itself. Both the butterfly valve and the check valve have position indication in the main control room.

ALTERNATIVES CONSIDERED

Cursory reviews of the efforts required to modify the lines in question was made. A summary of those reviews follows.

RHR Supply Line to Loop 1 and 3 Hot Legs

Modification of the RHR supply line to the loop 1 and 3 hot legs, penetration X-17, to meet the explicit requirements of GDC 55 would require a major redesign and reconstruction effort for this line. The modification would be to install a remote-manual power-operated valve outside containment to serve as an outboard containment isolation valve. The specific tasks that would be required to support the subject modification are:

1. Radiation dosage to the modifications crew.

2. Cost and time of procurement of suitable valve.

3. DNE work.

   A. Issue ECN and procure valve - Mechanical.
   B. Seismic analysis due to weight of new valve - Civil.
      1. Possible design of additional hangers.

4. Modification work.

   A. Issue workplan.
   B. Approval of workplan.
   C. Installation of valve - installation of handswitch and associated conduit and wiring to provide control room position indication of valve.
   D. Functional testing of valve.

5. Hydro of affected portion of system piping.

Containment Vacuum Relief Penetrations

Modification of the Containment Vacuum Relief penetrations to meet the explicit requirements of GDC 56 is not practical. Presently, both the containment vacuum relief butterfly isolation valve and the vacuum relief check valve are both located outside containment in the annulus area. In their present configuration, both valves are easily accessible for testing and maintenance. If a modification was required to put a valve inside containment, the same considerations as these for the RHR line would apply. Additionally, because of the location of the penetration (at the top of the containment vessel), access to an inboard valve would be limited at best. To gain access to these valves for maintenance or other purposes would require either a permanent ladder-type structure to be built to each of the three penetrations in question or would require scaffolding to be built in each instance that access to the valve is needed. In both cases, an undue personnel safety hazard would be created.

BASIS FOR EXEMPTION

The bases for applying for an exemption from the requirements of 10 CFR 50, Appendix A, GDC 55, for the RHR supply line to loop 1 and 3 hot legs and from the requirements of 10 CFR 50, Appendix A, GDC 56, for the containment vacuum relief penetrations follow.

RHR Supply Line to Loop 1 and 3 Hot Legs

The description of the RHR system identified redundant isolation provisions; two inboard check valves, an inboard remote manual valve, the closed system outside containment. These provisions ensure that no single failure could result in release of containment atmosphere to the environment. Therefore, protection of the health and safety of the public is ensured by the current design of this system. To modify the RHR supply line to loop 1 and 3 hot legs to comply explicitly with the requirements of 10 CFR 50, Appendix A, GDC 55, is not a viable alternative because of radiation exposure to the modification crew and increased plant capital cost. Thus, an exemption from the requirements of 10 CFR 50, Appendix A, GDC 55, should be granted for the RHR supply line to loop 1 and 3 hot legs in accordance with 10 CFR 50.12(a)(2)(ii), 10 CFR 50.12(a)(2)(iii), and 10 CFR 50.12(a)(2)(vi).

Containment Vacuum Relief Penetrations

The description of the containment vacuum relief penetrations identified redundant isolation provisions; each penetration is provided with a spring-loaded check valve and a butterfly valve that is equipped with two solenoid actuators powered by redundant air supplies. These provisions ensure that no single failure could result in the release of containment atmosphere to the environment. Therefore, protection of the health and safety of the public is ensured by the current design of this system. To modify the containment vacuum relief penetrations to comply explicitly with the requirements of 10 CFR 50, Appendix A, GDC 56, is not a viable alternative because of increased plant capital cost and increased difficulty in inspecting and maintaining the relocated valves. Thus, an exemption from the requirements of 10 CFR 50, Appendix A, GDC 56, should be granted for the containment vacuum relief penetrations in accordance with 10 CFR 50.12(a)(2)(ii), 10 CFR50.12(a)(2)(iii), and 10 CFR 50.12(a)(2)(vi).

ENVIRONMENTAL IMPACT EVALUATION

A brief environmental impact evaluation is provided for each of the systems for which an exemption from the requirements of 10 CFR 50, Appendix A, GDC 55 and 56, is provided.

RHR Supply Line to Loop 1 and 3 Hot Legs

The RHR supply line to loop 1 and 3 hot legs is provided with redundant isolation provisions; two inboard check valves and an inboard remote-manual valve, and a closed system outside containment. These redundant provisions ensure that no single failure could result in release of containment atmosphere to the environment. Specific testing is performed on the closed system to verify the integrity of the piping. Thus, it is concluded that the granting of an exemption from the requirements of 10 CFR 50, Appendix A, GDC 55, will not adversely impact the environment.

Containment Vacuum Relief Penetrations

Each of the three containment vacuum relief penetrations are provided with redundant isolation provisions; a spring-loaded check valve in series with butterfly valve that is equipped with two solenoid actuators which are powered from redundant air supplies. Furthermore, the design of the penetration is to allow for air to flow only from the annulus region into the containment. These redundant provisions and the design of the vacuum relief penetration itself ensure that no single failure could result in release of containment atmosphere to the environment. Also, the first outboard isolation valve is bolted directly to the containment, eliminating the possibility of a pipe rupture between the containment shell and the first isolation valve. Thus, it is concluded that the granting of an exemption from the requirements of 10 CFR 50, Appendix A, GDC 56, for the containment vacuum relief penetrations will not adversely impact the environment.

SUMMARY

Based on the descriptions of both the RHR supply line to loop 1 and 3 hot legs and the containment vacuum relief penetrations and the discussion of the basis for granting exemptions from the requirements of 10 CFR 50, Appendix A, GDC 55 and 56, it is our conclusion that the requested exemptions are authorized by law, will not present undue risk to the public health and safety, and are consistent with the common defense and security.

Table 1

CONTAINMENT VACUUM RELIEF PENETRATIONS
COMPARISON OF MAXIMUM AND ALLOWABLE STRESS LEVELS

LOAD COMBINATION	MAX. STRESS (ksi)	ALLOWABLE STRESS ASME CLASS MC (ksi)	BTP MEB 3-1 STRESS (ksi)	SERVICE LEVEL
P+DBE	1.65	15	16.2	B
DBA+DBE	7.54	32	16.2	C

P - Containment Design Pressure
DBE - Design Basis Earthquake
DBA - Dynamic effects due to the Design Basis LOCA