DCSM5-016

Docket Nos. 50-338
and 50-339

SEP 9 1983

Mr. W. L. Stewart
Vice President - Nuclear Operations
Virginia Electric and Power Company
Post Office Box 26666
Richmond, Virginia 23261

Dear Mr. Stewart:

SUBJECT: NUREG-0737, ITEM II.B.1, REACTOR COOLANT SYSTEM VENTS - NORTH ANNA POWER STATION, UNITS NO. 1 AND No. 2

By letters dated July 1, 1981 and April 23, 1982, the Virginia Electric and Power Company has provided information and details relating to the design of the reactor coolant system vents (RCSV) for the North Anna Power Station, Units No. 1 and No. 2. However, the implementation, schedule and requirement for a pre-implementation review have been superseded by the requirements of 10 CFR 50.44(c)(3)(iii). All operating reactors, in order to provide the improved operational capability required by the rule, must have the RCS vents installed, operational, procedures established and personnel trained in accordance with the schedule provided in the rule. An exemption is necessary if the specific design or schedular requirements of 10 CFR 50.44(c)(3)(iii) cannot be complied with.

The guidance in NUREG-0737, Item II.B.1, provides an acceptable means of meeting the design requirements of the rule for the RCS vents. Prior to promulgation of the rule, we have reviewed your responses identified above. The enclosed Safety Evaluation (SE) is based on the Technical Evaluation Report (TER) prepared by our consultant, Lawrence Livermore National Laboratory, and additional items which were outside the scope of the TER. The TER is attached to the SE. You will note our evaluation identifies specific items which are being addressed in conjunction with other ongoing NRC actions and areas where deficiencies may exist or confirmation is necessary to assure conformance with the rule.

We are providing the results of our review for your information. In addition, we have provided the information to Region II to assist them, as they deem appropriate, in determining your compliance with the requirements of 10 CFR 50.44(c)(3)(iii). If you have any questions relating to the enclosed SE, please contact Leon B. Engle, the NRC Project Manager.

We consider NUREG-0737, Item II.B.1, actions to be completed based on the requirements and promulgation of 10 CFR 50.44(c)(3)(iii).

Sincerely,

Original Signed by J. R. Miller

James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing

Enclosure:
As stated

cc: See next page

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SAFETY EVALUATION

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION UNITS 1 AND 2

DOCKET NOS. 50-338 AND 50-339

INTRODUCTION

The requirement for RCS vessel head and high point vents is stated in 10 CFR 50.44 paragraph (c)(3)(iii). Guidance is provided in NUREG-0737 "Clarification of TMI Action Plan Requirements," November 1980, Item II.B.1 Reactor Coolant System Vents and NUREG-0800 "Standard Review Plan" (SRP), July 1981, Section 5.4.12 Reactor Coolant System High Point Vents. The requirements of 10 CFR 50.44 for RCS high point vents specifically provide that the vent system shall: (1) be to ensure low probability of inadvertent or irreversible actuation and a high probability of operating when needed, (2) be remotely operable from the control room, (3) not aggravate the challenge to containment or the course of the accident, and (4) conform to the requirements of Appendices A and B of 10 CFR 50.

The licensee's responses to the above requirements have been evaluated by Lawrence Livermore Laboratory under contract to the Nuclear Regulatory Commission(NRC). The results of this evaluation are presented in the attachment entitled "Reactor Coolant System Vents (NUREG-0737, Item II.B.1) Final Technical Evaluation Report for North Anna 1 and 2".

The NRC staff review is based upon the Technical Evaluation Report (TER) and has been extended to items outside the scope of the TER, as specifically identified herein.

Certain items identified below may be subject to confirmation including a post-implementation review and audit to ensure compliance with 10 CFR 50.44(c)(3)(iii).

EVALUATION

The staff concurs with the TER recommendation that the North Anna 1 and 2 vent system design is acceptable provided the following items are satisfactorily resolved:

NUREG-0737 Item II.B.1 Clarification A (12) concerning human factor analysis requires consideration of the addition of vent system controls to the control room. Although this was discussed in the TER, the human factor analysis of control room modifications will be further addressed on an audit basis as part of the review of TMI Item I.D.1 "Control Room Design Reviews".

The NRC staff requires that the licensee confirm that the vent system will be fabricated and tested in accordance with SRP. Section 5.3.2 or the existing licensing basis for the reactor coolant pressure boundary. Also, the construction codes and standards for the piping and valves used in the Reactor Coolant System Vents were not specifically identified. The Codes and Standards shall be identified and available for NRC audit.

In respect of in-service testing, the NRC staff requires the licensee to exercise the RCS vent valves during cold shutdown or each refueling outage, and not every three months. This item must be confirmed by the licensee.

The following items are identified in the TER as being outside the scope of the contractor's review: seismic and environmental qualification, operating guidelines and procedures, technical specifications, and the inservice inspection program. The resolution of these items is as follows:

Seismic and Environmental Qualification: Seismic and environmental qualification will be audited in conjunction with generic audits of the licensee's Seismic and Environmental qualification program.

Operating Guidelines and Procedures: NUREG-0737 item II.B.1 requested procedures and analyses for operator use of the vents including the identification of the information available to the operator for initiating or terminating vent usage. The staff review of NUREG-0737 Item I.C.1 includes vent operating guidelines as an integral part of emergency operating procedures guidelines. It is our judgment that the owners group emergency operating guidelines as approved by the staff will provide an acceptable basis for the development of plant specific operating procedures. The plant procedures will be subject to NRC audits. We consider this approach a satisfactory resolution of operating procedures for RCS vents.

Technical Specifications: It is currently proposed to issue a generic letter to all licensees regarding the submittal of Proposed Technical Specifications for a number of NUREG-0737 items, including item II.B.1, which were required to be implemented after December 31, 1981. Technical specification requirements for the RCS vents will be included in this forthcoming licensing action.

Inservice Inspection Program: The vent system is an extension of the reactor coolant pressure boundary and must meet applicable inservice inspection requirements described by 10 CFR 50.55(g). The staff requires that the licensee include the RCS vent system in the inservice inspection program which is subject to NRC review and audit.

CONCLUSION

The staff safety evaluation is based on a review of the Technical Evaluation Report (TER) performed by Lawrence Livermore National Laboratory (attached), and the staff reviews of additional items outside the scope of the TER. The staff finds that the vent system at North Anna 1 and 2 is acceptable and in conformance with the requirements of 10 CFR 50.44 paragraph (c)(3)(iii) and the guidelines of NUREG-0737 Item II.B.1, and NUREG-0800 section 5.4.12. Certain items are subject to confirmation including post implementation NRC audit in conjunction with other ongoing actions/programs. These items are: (1) human factors analysis of control room modifications, (2) confirmation of conformance to SRP 5.2.3 or the existing related licensing basis, (3) identification of construction codes and standard (4) confirmation of a change in

frequency of exercising RCS vent valves from every 3 months to during cold shutdown on each refueling outage, (5) seismic and environmental qualification, (6) operating procedures, and (7) the in-service inspection program.

Technical Specifications will be the subject of a separate future licensing action.

Attachment: LLNL TER

Principal Contributor:
R. Licciardo

Lawrence Livermore National Laboratory

Selected Operating Reactor Issues Program II

Reactor Coolant System Vents (NUREG-00737, Item II.B.1.)
NRC FIN A0250 - Project 9

FINAL TECHNICAL EVALUATION REPORT FOR NORTH ANNA 1 AND 2

Docket Numbers 50-338 and 50-339
NRC TAC Numbers 44388 and 44389

Prepared by J. T. Held of Energy Incorporated - Seattle (Subcontract 4324401) for Lawrence Livermore National Laboratory under contract to the NRC Office of Nuclear Reactor Regulation, Division of Licensing.

NRC Lead Engineer - Gus Alberthal

TF-345/0809a

February 23, 1983

Docket Numbers 50-338 and 50-339
NRC TAC Numbers 44388 and 44389

TECHNICAL EVALUATION REPORT ON REACTOR COOLANT SYSTEM VENTS FOR NORTH ANNA 1 AND 2

INTRODUCTION

The requirements for reactor coolant system high point vents are stated in paragraph (c)(3)(iii) of 10 CFR 50.44, "Standards for Combustible Gas Control System in Light Water Cooled Power Reactors," and are further described in Standard Review Plan (SRP) Section 5.4.12, "Reactor Coolant System High Point Vents," and Item II.B.1 of NUREG-0737, "Clarification of TMI Action Plan Requirements." In response to these and previous requirements, the Virginia Electric and Power Company has submitted information in References 1 through 4 in support of the vent system at Units 1 and 2 of the North Anna Power Station.

EVALUATION

The function of the reactor coolant system (RCS) vent system is to vent noncondensible gases from the high points of the RCS to assure that core cooling during natural circulation will not be inhibited. The North Anna 1 and 2 RCS vent system provides venting capability from high points of the pressurizer and the reactor vessel head. The noncondensible gases, steam, and/or liquids vented from either the pressurizer or the reactor vessel head are separately piped and discharged directly to the refueling cavity. The RCS vent system is designed to vent with either vent path a volume of gas approximately equal to one half of the RCS volume in one hour. A flow restriction orifice in each RCS vent path, however, limits the flow from a pipe rupture or from inadvertent actuation of the vent system to less than the definition of a LOCA (i.e., to less than the capability of the reactor coolant makeup system). Hence, the licensee's compliance with 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors," is not affected by the addition of the RCS vent system.

The RCS vent system paths from the pressurizer and the reactor vessel head to the refueling cavity each contain two parallel sets of two solenoid-operated valves in series which are remotely controlled from the main control room. Positive indication of valve position is also provided by means of two position indicating switches which are an integral part of each valve and light indication in the main control room. A degree of redundancy has been provided by powering one parallel vent path from both the pressurizer and reactor vessel head from Emergency Train A, and the second parallel path from Emergency Train B, to ensure that RCS venting capability from each high point is maintained. RCS vent system valve seat leakage is detected, together with other unidentified RCS leakage, by way of increased makeup requirements, containment sump level monitors, containment atmosphere airborne radioactivity, and containment pressure.

The portion of each RCS vent path up to and including the second normally closed valve forms a part of the reactor coolant pressure boundary and thus must meet reactor coolant pressure boundary requirements. The licensee has stated that this portion of the vent system is designated Safety Class 2 (Safety Class 1 upstream of the flow restriction orifices) and Seismic Category 1 in compliance with 10 CFR 50.55a and Regulatory Guides 1.26 and 1.29. The RCS vents are designed for pressures and temperatures corresponding to the RCS design pressure and temperature. In addition, the vent system materials are compatible with the reactor coolant chemistry, and the reactor vessel head vent and the pressurizer vent are acceptably separated and protected from missiles and the dynamic effects of postulated piping ruptures. However, the licensee has not verified that the vent system will be fabricated and tested in accordance with SRP Section 5.2.3. We therefore conclude that the design of the portions of the RCS vent system up to and including the second normally closed valve conforms to all reactor coolant pressure boundary requirements, including 10 CFR 50.55a and the applicable portions of General Design Criteria 1, 2, 4, 14, 30, and 31, contingent on verification of acceptable fabrication and testing provisions. The licensee has further ascertained that the essential operation of other safety-related systems will not be impaired by postulated failures of RCS vent system components.

We have reviewed the licensee's RCS vent system design to assure an acceptably low probability exists for inadvertent or irreversible actuation of the vent system. Each vent path has two solenoid-operated valves in series, and each valve has a separate key locked control switch under administrative control. The valves are powered by vital DC buses

energized by the safety power trains and fail to the closed position in the event of loss of power. The licensee has stated that the controls and displays added to the main control room will be considered in a human factors analysis to be conducted at a later date in accordance with NUREG-0737 Item I.D.1, "Control-Room Design Reviews." We therefore find that no single active component failure or human error should result in inadvertent opening or failure to close after intentional opening of the RCS vent system.

We have also examined the locations where the vent system normally discharges to the containment atmosphere in the vicinity of the refueling cavity. Based on a description provided by the licensee (Reference 2), these locations are in an area that assures good mixing with the containment atmosphere to prevent the accumulation or pocketing of high concentrations of hydrogen in compliance with 10 CFR 50.44, "Standards for Combustible Gas Control System in Light Water Cooled Power Reactors." Additionally, these locations are such that the operation of safety-related systems would not be adversely affected by the discharge of the anticipated mixtures of steam, liquids, and noncondensible gases, and have minimal active components functioning during an accident.

The licensee has stated that operability testing will be in accordance with subsection IWV of Section XI of the ASME Code for Category B valves. However, the licensee has not stated that the RCS vent valves will be exercised during cold shutdown or refueling instead of every three months. This is a confirmatory item.

CONCLUSION

We conclude that the North Anna 1 and 2 Reactor Vessel Head and Pressurizer Venting System design is sufficient to effectively vent noncondensible gases from the reactor coolant system without leading to an unacceptable increase in the probability of a LOCA or a challenge to containment integrity, meets the design requirements of NUREG-0737 Item II.B.1 and the applicable portions of General Design Criteria 1, 2, 4, 14, 30, and 31, and conforms to the requirements of paragraph (c)(3)(iii) of 10 CFR 50.44. We therefore recommend that the North Anna 1 and 2 RCS vent system design be found acceptable with the following two confirmatory items. The licensee must commit to exercise the RCS vent valves during cold shutdown or refueling instead of every three months in accordance with the requirements of subsection IWV of Section XI of ASME Code for Category B valves, and provisions to fabricate and test the portions of the vent system

that form part of the reactor coolant pressure boundary must be determined to be acceptable. It should also be noted that the following items were excluded from the scope of our review: seismic cnd environmental qualification of the RCS vent system, RCS vent system operating guidelines and procedures, and required modifications to the plant technical specifications and in-service inspection program for RCS vent system.

REFERENCES

1. Letter, B.R. Sylvia (Virginia Electric and Power Company) to H.R. Denton (NRC), "Additional Information, Reactor Coolant System Vents, North Anna Unit 2," dated July 10, 1980

2. Letter, B.R. Sylvia (Virginia Electric and Power Company) to H.R. Denton (NRC), with enclosure," Response to NUREG-0737 Post-TMI Requirements," dated December 15, 1980

3. Letter, R.H. Leasburg (Virginia Electric and Power Company) to H.R. Denton (NRC), "Reactor Coolant System Vents, North Anna Unit 1 and 2," dated July 1, 1981

4. Letter, R.H. Leasburg (Virginia Electric and Power Company) to H.R. Denton (NRC), "Request for Additional Information, Reactor Coolant System Vents (Item II.B.1), North Anna Power Station Units 1 and 2," dated April 23, 1982