ENCLOSURE (2)

LAWRENCE LIVERMORE 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 INDIAN POINT 3

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TECHNICAL EVALUATION REPORT ON REACTOR COOLANT SYSTEM VENTS FOR INDIAN POINT 3

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 Power Authority of the State of New York has submitted information in References 1 through 4 in support of the vent system at the Indian Point 3 Nuclear Power Plant.

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 Indian Point 3 Reactor Vessel Head Vent System (RVHVS) provides venting capability from high points of the reactor vessel head and the existing power operated relief valves (PORVs) provide the capability to vent the pressurizer. The noncondensible gases, steam, and/or liquids vented from either the reactor vessel head or the pressurizer are piped and discharged to the Pressurizer Relief Tank (PRT). The RVHVS is designed to vent a volume of gas approximately equal to one half of the RCS volume in one hour through either of two redundant vent paths. A flow restriction orifice in each RVHVS path, however, limits the flow from a pipe rupture or from inadvertent actuation of the vent system 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 in Light Water Power Reactors," is not affected by the addition of the RVHVS.

The RVHVS consists of two redundant vent paths from the reactor vessel head to the PRT, each containing two solenoid-operated isolation valves in series which are remotely controlled from the main control room. Positive indication of valve position for the RVHVS is provided by stem position switches on the isolation valves and by status lights in the main control room. A degree of redundancy has been provided by powering each RVHVS path from a different vital power supply to ensure that RCS venting capability from the reactor vessel is maintained. Pressurizer venting is provided through the existing PORVs and associated motor-operated block valves. The licensee has stated that positive position indication for the motor-operated block valves in the pressurizer vent path is provided by closed/open limit switches which energize a green and red indicating light, respectively, on panel FCF in the control room. Position indication of the PORVs is provided by both limit switches and acoustic monitoring. RVHVS or pressurizer vent valve seat leakage can be detected by changes in PRT pressure, temperature, or level.

The portion of each RVHVS 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 I in compliance with 10 CFR 50.55a and Regulatory Guides 1.26 and 1.29. The RVHVS is designed for pressures and temperatures corresponding to the RCS design pressure and temperature. In addition, the RVHVS materials of construction are austentic stainless steel of the following types which are compatible with the reactor coolant chemistry:

Component	Material
Piping	SA-376TP316
Fittings (except laterals)	SA-182F316
Laterals	SA-403WP316
Solenoid Valves (Body)	SA-182F316
Manual Valve (Body)	SA-182F316
Modified Top Cap	SA-479TP304

All material was purchased, fabricated and tested in accordance with ASME Section III, Class 1 or 2 requirements. The RVHVS and the pressurizer PORV vents are also acceptably separated and protected from missiles and the dynamic effects of postulated piping ruptures. We therefore conclude that the design of the portions of the RVHVS 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. The licensee has further verified that the RVHVS is designed, supported, and routed such that essential operation of other safety-related systems will not be impaired by postulated failure of vent system components.

We have reviewed the licensee's RVHVS design to assure an acceptably low probability exists for inadvertent or irreversible actuation of the vent system. Each RVHVS path has two solenoid-operated valves in series, and each valve has a separate close/open selector switch. Position indicating lights are located next to the selector switch for each RVHVS valve, and a separate monitor light that receives position indication signals from all four valves is also provided. The RVHVS valves are powered by vital power supplies and fail to the closed position in the event of loss of power. The licensee has stated that the recommendations of their human factors review of the main control room will be considered in the addition of RVHVS controls and displays to the main control room in order to minimize the potential for operator error. However, the Indian Point 3 RVHVS design includes Target Rock solenoid-operated valves, which may be susceptible to a common mode failure because operation of one valve may cause other valves in the system to open temporarily (see Reference 5). The licensee will be required to evaluate this problem and present their conclusions including any design changes necessary to minimize the probability of an inadvertent vent system actuation. We therefore find that no single active component failure or human error should result in inadvertent opening or irreversible operation (i.e., failure to close after intentional opening) of the RVHVS, contingent on satisfactory resolution of the problem with Target Rock solenoid-operated valves.

We have also examined the location where the RVHVS and PORV vent systems would discharge to the containment atmosphere through the PRT rupture disc. Based on a word description provided by the licensee (Reference 4), this area is located below a containment fan cooler vent and will assure good mixing with the containment atmosphere and 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."

The licensee has stated that operability testing for the RVHVS 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 RVHVS valves will be exercised during cold shutdown or refueling instead of every three months. This is a confirmatory item. The PORVs and block valves are tested for operability each refueling outage in accordance with the Technical Specifications.

CONCLUSIONS

We conclude that the Indian Point 3 RVHVS and pressurizer PORV vent 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 Indian Point 3 RCS vent system design be found acceptable with the following two confirmatory items. The Target Rock solenoid-operated valve problem noted above must be satisfactorily resolved, and the licensee must commit to exercise the RVHVS valves during cold shutdown or refueling instead of every three months in accordance with the requirements of subsection IWV of Section XI of the ASME Code for Category B valves. It should also be noted that the following items were excluded from the scope of our review: seismic and environmental qualification of the RVHVS, RVHVS operating guidelines and procedures, and required modifications to the plant technical specifications and in-service inspection program for the RVHVS.

REFERENCES

1. Letter, P.J. Early (Power Authority of the State of New York) to A. Schwencer (NRC), "TMI LLTF Requirements, Indian Point 3 Nuclear Power Plant," dated January 8, 1980.

2. Letter, P.J. Early (Power Authority of the State of New York) to A. Schwencer (NRC), "Response to TMI LLTF Short-Term Requirements, Indian Point 3 Nuclear Power Plant," dated February 3, 1980.

3. Letter, J.P. Bayne (Power Authority of the State of New York) to D.G. Eisenhut (NRC), "Indian Point 3 Nuclear Power Plant, Docket No. 50-286, Post TMI-Requirements - NUREG-0737, Item II.B.1 - Reactor Coolant System Vents," dated July 31, 1981.

4. Letter, J.P. Bayne (Power Authority of the State of New York) to S.A. Varga (NRC), "Indian Point 3 Nuclear Power Plant, Docket No. 50-286, Reactor Coolant System Vents, (Item II.B.1, NUREG-0737)," dated April 27, 1982.

5. NRC Memorandum, T.P. Speis (Division of Systems Integration) to T.M. Novak (Division of Licensing), "Unintentional Lifting of Solenoid Operated Pilot Valves in RCS Vent System," dated March 9, 1982.