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 2

Docket Number 50-247
NRC TAC Number 44378

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

NOTICE

TF-381/0823a

April 6, 1983

University of California P.O. Box 808 Livermore, California 94550 Telephone (415) 422-1100 Twx 910-386-8339 UCLL LVMR

TECHNICAL EVALUATION REPORT
ON REACTOR COOLANT SYSTEM VENTS
FOR INDIAN POINT 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 Consolidated Edison Company of New York has submitted information in References 1 through 4 in support of the vent system at Indian Point Unit No. 2.

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 2 Remote Reactor Head Vent (RRHV) system 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 the reactor vessel head are piped and discharged to the containment atmosphere and the discharges from the pressurizer are piped to the pressurizer relief tank (PRT). The RRHV is designed to vent a volume of gas approximately equal to one half of the RCS volume in one hour. The size of the new RRHV tubing 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 RRHV.

The RRHV consists of one vent path from the reactor vessel head to the containment atmosphere containing two motor-operated valves in series which are remotely controlled from the central control room. Indication of valve position is provided by an acoustic flow monitor, and by position lights for each valve for both open and closed position indication in the control room. These position lights receive signals from the torque switches associated with the Limitorque motor operators. Pressurizer venting is provided through the existing PORVs and associated motor-operated block valves. Positive position indication of the block valves and PORVs is provided in the central control room. A degree of redundancy has been provided by powering the PORVs from separate vital batteries, and the RRHV motor-operated valves from diverse emergency buses supplied by the diesel generators. The PORV block valves are powered by the same diverse emergency buses as the RRHV valves. This arrangement ensures that RCS venting capability is maintained after failure of one emergency power train. RRHV, PORV, and associated block valve seat leakage can be detected and monitored as part of the RCS leakage requirements specified in the technical specifications.

The portion of the RRHV system 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 classified Seismic Category I and Consolidated Edison Class A and is designed and installed in accordance with the original requirements for reactor coolant pressure boundary installations. The RRHV is designed for pressures and temperatures corresponding to the RCS design pressure and temperature. The licensee has stated that the materials of construction of piping, valves, and fittings are stainless steels and are compatible with reactor coolant chemistry, and that the RRHV System components were installed consistent with the original plant reactor coolant pressure boundary design criteria, ASME and ANSI codes applicable to Indian Point 2. The RRHV 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 RRHV up to and including the second normally closed valve conforms to all reactor coolant pressure boundary requirements, including the applicable portions of General Design Criteria 1, 2, 4, 14, 30, and 31. The licensee has further ascertained that the essential operation of other safety-related equipment will not be impaired by the postulated failure of RRHV system components.

We have reviewed the licensee's RRHV design to assure an acceptably low probability exists for inadvertent or irreversible actuation of the vent system. The RRHV has two motor-operated valves in series powered by diverse emergency power buses. Each valve has a separate close/open selector switch and positive position indicating lights. A separate acoustic flow monitor also indicates when the RRHV valves are open. Furthermore, the licensee has stated that the RRHV system displays and controls were considered in an overall review of human factors engineering of the central control room. 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 RRHV system.

We have also examined the location where the RRHV system would discharge to the containment atmosphere. Based on a word description provided by the licensee (Reference 2), the location of the discharge point of the reactor head vent is at the top of the steam generator shield wall. This is a completely open area above the operating floor (Elevation 95 feet), so that trapped pockets of noncondensible gases cannot be formed. Mixing and cooling will occur as the gases are drawn through the containment fan cooler units. This assures good mixing with the containment atmosphere and prevents 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, the discharge location is such that operation of safety-related systems would not be impaired by the discharge of the anticipated mixtures of steam, liquids, and noncondensible gases.

The licensee has stated that operability testing for the RRHV valves, PORVs and block valves 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 these valves will be exercised during cold shutdown or refueling instead of every three months. This is a confirmatory item.

CONCLUSION

We conclude that the design of the Indian Point 2 RCS vent system, which includes the RRHV system and the pressurizer PORVs and block valves, 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 conforms to the requirements of paragraph (c)(3)(iii) of 10 CFR 50.44. We therefore recommend that the Indian Point 2 RCS vent system design be found acceptable with the following confirmatory item. 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 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 RCS vent system, RCS vent system operating guidelines and procedures, and required modifications to the plant technical specifications and in-service inspection program for the RCS vent system.

REFERENCES

1. Letter, P. Zarakas (Consolidated Edison Company of New York, Inc.) to H.R. Denton (NRC), "Implementation of TMI-2 Lessons Learned Task Force Recommendations," dated December 31, 1979.

2. Letter, P. Zarakas (Consolidated Edison Company of New York, Inc.) to H.R. Denton (NRC), "Supplemental Information Regarding Implementation of TMI-2 Lessons Learned Task Force Recommendations," dated February 15, 1980.

3. Letter, J.D. O'Toole (Consolidated Edison Company of New York, Inc.) to D.G. Eisenhut (NRC), "Commitments Regarding NUREG-0737 'Clarification of TMI Action Plan Requirements'," dated July 1, 1981.

4. Letter, J.D. O'Toole (Consolidated Edison Company of New York, Inc.) to S.A. Varga (NRC), with Attachment A, "Response to February 25, 1982 Request for Additional Information for Indian Point 2," dated June 2, 1982.