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April 1, 1982

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Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket 50-206
Post TMI Requirements, NUREG-0737
Documentation Requirements

References:

1. Letter, D. G. Eisenhut, to All Licensees of Operating Plants and Applicants For Operating Licenses and Holders of Construction Permits, October 31, 1980

2. Letter, K. P. Baskin, SCE, to D. M. Crutchfield, NRC, Clarification of TMI Action Plan Requirements, December 8, 1981

3. Letter, K. P. Baskin, SCE, to D. M. Crutchfield, NRC, Design Detail Information, San Onofre Unit 1, October 16, 1980

Reference 1 forwarded NUREG-0737 containing all TMI-Related items approved for implementation by the Commission at that time. NUREG-0737 provided new schedules and clarification of the post-TMI Action Plan. Reference 2 was our statement that the NUREG-0737 items discussed therein would be implemented prior to start-up from the steam generator inspection outage to commence on or before June 1, 1982. San Onofre Unit 1 shutdown on February 27, 1982 to perform the required steam generator inspection, to implement the seismic modifications to the west feedwater heater platform and north turbine building extension and to complete TMI modifications discussed in Reference 2 above.

The purpose of this letter is to provide the design details for those TMI modifications discussed above which require preimplementation review by the NRC staff. As stated in NUREG-0737, TMI Action Plan Item II.B.1, Reactor Coolant System Vents, required the submittal of design details for a preimplementation design review.

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The system description provided to you as Enclosure 2 to Reference 3 has been revised and is submitted as Enclosure 1 to this letter. Enclosure 2 to this letter provides the design discussion requested by NUREG-0737 for the Reactor Coolant System Vents and Enclosure 3 provides the current engineering drawings necessary to perform an independent design review. In addition, it should be noted that the system operating procedures for the reactor coolant vent system are currently being prepared and are currently scheduled for completion on April 16, 1982. We will submit the system operating procedures for your review and the approval by April 23, 1982.

If any additional information is necessary to complete your review, please let me know.

Very truly yours,

RWKrieger for KPBaskin

Enclosure

cc: R. H. Engelken, Director, OIE, Region V

ENCLOSURE 1

REACTOR COOLANT VENTING SYSTEM (RCVS), CONTROLS DESCRIPTION
WP 3-2 SONGS 1, TMI Phase II

FUNCTION

The function of the reactor coolant venting system is to vent non-condensible gases from the reactor head, hot legs, and pressurizer, via high point vents located on the reactor head and pressurizer.

REFERENCE DRAWINGS

Description	Drawing No.
Piping & Instrumentation Diagram	568776
Valve Logics Train A	235859
Valve Logics Train B	235858

DESIGN DESCRIPTION

Systems

The Reactor Coolant Venting System is comprised of two separate subsystems, one vents the reactor vessel and the second vents the pressurizer and hot legs. The reactor vessel vent system modification starts at the existing reactor head vent line and proceeds downstream to a restriction orifice to limit the flow to less than 90 gallons per minute. This design allows the venting of the approximate 42,000 standard cubic feet of hydrogen within one (1) hour (this is the amount of hydrogen produced during the first 48 hrs. following an accident, assuming a 17% core metal hydrogen/water reaction, per Westinghouse report WCAP-9636). The orifice for the pressurizer vent system is sized for the same conditions. The orifice will control the reactor coolant flow rate in the event of a downstream line break.

The discharge lines downstream of each orifice leads to a series of fail closed block and vent solenoid valves. The reactor vessel line 5000-3/4"-2501R, leads to valves SV-2401 and SV-3401, which are upstream up valves SV-2402 and SV-3402. Similarly, the pressurizer line 5033-3/4"-2501R leads to valves SV-2403 or SV-3403 and downstream valves SV-2404 or SV-3404.

VENTING OPERATION

The control location for the head vent system is the Auxiliary Feedwater (AWF) control panel located in the Main Control Room. The controls are divided into the train A and B compartments. The associated alarms are is located in the non-train aligned section of the panel. The control buttons for testing, silencing, and acknowledging the annunciator are mounted in the center control console in the main control, adjacent to the Auxiliary feedwater panel.

Valve Configuration

The head vent control system consists of two remote control high point venting ports. One is located on the reactor head and the other is located on the pressurizer. Each venting point consists of four remote operated 3/4" solenoid valves with stem actuated position switches. The valves are arranged in two groups of parallel valves. The first set of parallel valves is identified as vent valves, they are positioned downstream of the vent line orifice. The second set of parallel valves is positioned downstream of the vent valves.

The system with two parallel valves mounted in series with two parallel vent valves give operational flexibility. It provides redundancy to assure venting when required, as well as giving direction to the vented gas stream (i.e., venting to either the pressurizer relief tank or directly into containment). In addition, this arrangement prevents systems leakage in this event that a single valve is stuck open thus assuring the reactor coolant system integrity under single failure conditions.

Reactor Head Venting

The controls for head venting are located in the Auxiliary Feedwater Panel (C-71) in the main Control Room (MCR). Under normal operation with both vital buses available, the venting of the reactor coolant system can be accomplished from the A train or B train side of the Auxiliary Feedwater Panel.

To operate the venting system from the train A side of the panel, the master power pushbutton (HS-2210A) must be actuated. When depressed, the system is powered and the "on" status is indicated by a red light. When the power is off, the status is indicated by a green light. Next the reactor head vent block valve SV-2401 is opened by depressing pushbutton HS-2401A, which is located directly below the master power pushbutton. The valve's open position is indicated by a red light located on the back of the pushbutton. The close valve position is indicated by a green light on the back of the close pushbutton. With the valve open, the process fluid within the reactor is exposed to the second set of valves which are located directly downstream of the vent valves. The green status light for the vent valves gives indication that the valves are closed. Next, the operator depresses pushbutton HS-2402A to open solenoid valve SV-2402. The red status light is illuminated to indicate that the valve is open. This action commences venting the reactor head into the containment. If venting to the pressurizer relief tank is desired, actuation of the train B venting system is necessary.

On the train B side of the panel, there is a similar master power switch. The Pushbutton arrangement is identical to the train A side of the panel. To energize the train B System the master power pushbutton HS-3212A is depressed. When the system is energized, a red system power "on" status light will illuminate and the green "off" position light is de-energized. Next, the reactor vent valve SV-3401 is energized open via pushbutton HS-3401A. When the valve is open the position switches located on the valve stem will de-energize the green "close" status light and energize the red valve open status light. Next, pushbutton HS-3402A is depressed to energizing valve SV-3402, the valve status lights will switch from green to red as the process fluids from the reactor are vented to the pressurizer relief tank.

Pressurizer Venting

The pressurizer is vented in a similar manner to the reactor head. The head vent and pressurizer control systems are located next to each other on the Auxiliary Feedwater Panel (C-71). Under normal conditions with both vital buses in operation, the venting can be accomplished from both the train A and train B sides of the Auxiliary Feedwater Panel. On the train A side of the panel, the master power pushbutton HS-2214A is depressed. This energizes the train A system, and illuminate the red power light, and de-energizes the green off light. Next, the pressurizer vent valve SV-3403 is opened by depressing pushbutton HS-3403A. This pushbutton is located directly below the master power pushbutton. As the valve changes position, a corresponding change in the valve position status lights will also occur. Red indicates valve open, green indicates valve closed. With the valve in the open position, process fluid within the pressurizer is exposed to the closed valves which are located downstream of the vent valves. Status lights on the valves gives indication that the valves are closed. Next, the operator depresses pushbutton HS-3404A to energize valve SV-3404. This action commences venting into the containment. If venting to the pressurizer relief tank is desired, actuatation of the train B venting system is necessary.

On the train B side of the panel there is a similar master power switch. The pushbutton arrangement is identical to the train A side. To energize the train B valves, the master power pushbutton HS-3216A is depressed. When the train is energized, the system power status lights will switch position, red indicates system power is on, green indicates system power is off. Next, the pressurizer vent valve is opened, the pushbutton HS-3403A energizes valve SV-3403. When the valve is open, a positive action position switch located on the valve stem will de-energized the green "close" status light and energize the red "open" status light. Pushbutton HS-3404A is depressed to energize valve SV-3404 to open. The process fluid on the pressurizer vents to the pressurizer relief tank and the valve "open" status light the will illuminate red.

ABNORMAL OPERATIONS

Loss of Train A

In the event that vital bus 1 or single components in train A are not available, both the pressurizer and reactor head can be vented. The reactor head venting will be restricted to the pressurizer relief tank and the pressurizer will be vented into containment.

Loss of Train B

In the event that vital bus 2 or single components in train B are not available, both the pressurizer and reactor head can both be vented. The reactor head venting will be restricted to the containment and the pressurizer will be vented into the pressurizer relief tank.

Single Valve Failure

In the event that a single valve fails open, the operator is alerted in a positive manner. Position switches on the block and vent solenoid valves are connected to their respective back lighted pushbuttons and annunciator module (K-04) on the AWF panel (C-71). The annunciator provides four alarm points to give the operator greater diagnostics from the control room. The alarm windows provided are:

1. Reactor head vent open train A
2. Pressurizer vent open train A
3. Reactor head vent open train B
4. Pressurizer vent open train B

The annunciator will hold the alarm point until reset by the operator. The operational controls for the annunciator are: test, lamp reset, and alarm reset. In the test mode, the annunciator lights are simultaneously energized. In the lamp reset mode, the annunciator will switch from flashing red to the steady red and silence the chimb sound. The steady red light will be de-energized when the original fault is corrected and the alarm reset pushbutton is depressed.

In the event that a single valve in either train fails open, redundant valves assure that the reactor head and pressurizer will remain isolated. In addition, a single valve failure will not prevent system venting (see loss of train A & B).

Single Switch Failure

In the event that a single valve pushbutton fails, the system will function in safe manner. If a pushbutton fails to de-energize a valve, the valve can be released to its electrical failure position by de-energizing the master power circuit. If a switch fails to energize and open a vent or block valve, a redundant complimentary train is available.

Master Power Switch Failure

If the master power switch fails in the power "on" position, the valves will operate in their normal manner. As an additional safety measure, the circuit power fuse can be disconnected to assure that all valves are not energized.

Backlighted Pushbutton Bulb Failure

Each pushbutton station is back lighted by two light bulbs. In the event that a single bulb burns out, the operator can identify the status of the switch from the second bulb. In addition, the operator can identify that a single bulb has burned out by visual inspection. The problem will be corrected as part of normal maintenance.

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ENCLOSURE 2

II.B.1 REACTOR COOLANT SYSTEM VENTS

In response to the requirements of NUREG-0737, Item II.B.1 Reactor Coolant System Vents, SCE has designed a system to vent the high points in the reactor vessel head and reactor coolant system (RCS) piping. The reactor vessel and pressurizer each have an existing 3/4" vent line to vent noncondensible gases which will be modified to allow for remote operation from the control room. The modification will involve extending the existing reactor vessel or pressurizer vent line to the pressurizer relief tank and to a new flash pot as noted in the attached SCE Drawing 568766-17.

The modification is designed to meet both Seismic I and single failure criteria. Restricting orfices are included in the design which will limit liquid flows below the Loss-Of-Coolant Accident (LOCA) definition and will minimize the likelihood of activating the Emergency Core Cooling System (ECCS) in the event of a failure in the venting system.

The following is a response to the specific questions required by NUREG-0737, Item II.B.1, Reactor Coolant System Vents.

Clarification

A. General

Item 1. The important safety function enhanced by this venting capability is core cooling. For events beyond the present design basis, this venting capability will substantially increase the plant's ability to deal with large quantities of noncondensible gas which could interfere with core cooling.

Response No response required.

Item 2. Procedures addressing the use of the reactor coolant system vents should define the conditions under which the vents should be used as well as the conditions under which the vents should not be used. The procedures should be directed toward achieving a substantial increase in the plant being able to maintain core cooling without loss of containment integrity for events beyond the design basis. The use of vents for accidents within the normal design basis must not result in a violation of the requirements of 10 CFR 50.44 or 10 CFR 50.46.

Response The Westinghouse Owners Group developed generic procedures for Reactor Vessels Head Vent Operation and Background for Reactor Vessel Head Vent Operation in February 1981. We are currently reviewing these procedures along with our design for incorporation into either existing or new operating instructions. The procedure(s) will be forwarded to you when available.

Item 3. The size of the reactor coolant vents is not a critical issue. The desired venting capability can be achieved with vents in a fairly broad spectrum of sizes. The criteria for sizing a vent can be developed in several ways. One approach, which may be considered, is to specify a volume of noncondensible gas to be vented and in a specific venting time. For containments particularly vulnerable to failure from large hydrogen releases over a short period of time, the necessity and desirability for contained venting outside the containment must be considered (e.g., into a decay gas collection and storage system).

Response Westinghouse Report No. WCAP-9636 dated November 1979 concluded that a 5% metal-water reaction provides a conservative estimate for total H_2 production and producion rate for stainless steel fuel cladding. However, to establish an even more conservative design, a 17% reaction case was assumed. Based on the higher H_2 generation rate and assuming no venting until 48 hours after H_2 production commences, approximately 42,100 SCF of gas would be trapped within the system. Through the longest flow path, the reactor vent piping, can vent 290,000 SCF per hour which is approximately 7 times greater than the trapped volume of H_2 gas after 48 hours of producton.

Item 4. Where practical, the reactor coolant system vents should be kept smaller than the size corresponding to the definition of LOCA (10 CFR 50, Appendix A). This will minimize the challenges to the Emergency Core Cooling System (ECCS) since the inadvertent opening of a vent smaller than the LOCA definition would not require ECCS actuation, although it may result in leakage beyond technical specification limits. On PWRs, the use of new or existing lines whose smallest orifice is larger than the LOCA definition will require a valve in series with a vent valve that can be closed from the control room to terminate the LOCA that would result if an open vent valve could not be reclosed.

Response Restricting orifices are included in the design at both the reactor vessel and pressurizer which will limit flow rates below the maximum flow rate of the charging pump. The orifices are located as close as practical to the vessel heads.

Item 5. A positive indication of valve position should be provided in the control room.

Response A positive indication is provided by backlighted pushbutton control switches in the auxiliary feedwater control panel C-71, which is located in main control room.

Item 6. The reactor coolant vent system shall be operable from the control room.

Response Control panel C-71 is located in the main control room.

Item 7. Since the reactor coolant system vent will be part of the reactor coolant system pressure boundary, all requirements for the reactor pressure boundary must be met, and, in addition, sufficient redundancy should be incorporated into the design to minimize the probability of an inadvertent actuation of the system. Administrative procedures, may be a viable option to meet the single-failure criterion. For vents larger than the LOCA definition, an analysis is required to demonstrate compliance with 10 CFR 50.46

Response All requirements for the reactor pressure boundary have been met with this design:

1. Redundant isolation is provided (2 valves in series).
2. The valves are designed to fail in the closed position.
3. The control design requires three separate actions to initiate venting:
   a. energize solenoid circuits, b. open one (of two) vent valves, c. open one (of two) block valves.
4. Restricting orifices are included in the vent lines, which limit flow below the LOCA definition.

Item 8. The probability of a vent path failing to close, once opened, should be minimized; this is a new requirement. Each vent must have its power supplied from an emergency bus. A single failure within the power and control aspects of the reactor coolant vent system should not prevent isolation of the entire vent system when required. On BWRs, block valves are not required in lines with safety valves that are used for venting.

Response The valves as discussed in the response to item 7 above are designed to fail in the closed position and the redundant isolation capability provides assurance that a vent path will be able to be closed, once opened.

Under normal operation DC vital bus 1 provides power for train A and DC vital bus 2 provides power for train B. Each bus is an independent source of power for the valves. The venting of the reactor coolant system can be accomplished from either train A or B at auxiliary feedwater control panel C-71. In the event of a single failure in one bus, the venting system will still be operable.

Item 9. Vent paths from the primary system to within containment should go to those areas that provide good mixing with containment air.

Response The H_2 gas can be routed to either the existing pressure relief tank for small releases and for testing, or to the new flash pot. The flash pot vents to an existing reactor vent pipe, which conducts the gases outside the secondary shielding to the main containment air space. Containment sprays provide adequate mixing in this area.

Item 10. The reactor coolant vent system (i.e., vent valves, block valves, position indication devices, cable terminations, and piping) shall be seismically and environmentally qualified in accordance with IEEE 344-1975 as supplemented by Regulatory Guide 1.100, 1.92 and SEP 3.92, 3.43, and 3.10. Environmental qualifications are in accordance with the May 23, 1980, Commission Order and Memorandum (CLI-80-21).

Response The design meets all seismic and environmental qualifications discussed in item 10.

Item 11. Provisions to test for operability of the reactor coolant vent system should be a part of the design. Testing should be performed in accordance with subsection IWV of Section XI of the ASME Code for Category B valves.

Response Provisions have been made in the design for testing the operability of the reactor coolant system vents. The design provides for individual test and indication of each valve. Station maintenance procedures which are to be written for surveillance of the vent system will be developed in accordance with the ASME requirements noted in item 11.

Item 12. It is important that the displays and controls added to the control room as a result of this requirement not increase the potential for operator error. A human-factor analysis should be performed taking into consideration:

(a) The use of this information by an operator during both normal and abnormal plant conditions.

(b) Integration into emergency procedures,

(c) integration into operator training, and

(d) other alarms during emergency and need for prioritization of alarms.

Response Human engineering was considered in the design, however, no formal human engineering analysis was performed.

(a) Annunciation and positive indicating lights are provided for the plant operator which can be utilized both during normal and emergency plant conditions.

(b) and (c)
Station personnel are currently reviewing both station procedures and operator training programs to incorporate the reactor coolant vent system.

(d) On the auxiliary feedwater control panel, an area has been dedicated exclusively for reactor coolant vent system annunciation which will allow the operator to evaluate alarms during an emergency situation.

B. BWR Design Considerations

Not applicable

C. PWR Vent Design Conditions

Item 1. Each PWR licensee should provide the capability to vent the reactor vessel head. The reactor vessel head vent should be capable of venting noncondensible gas from the reactor vessel hot legs (to the elevation of the top of the outlet nozzle) and cold legs (through head jets and other leakage paths).

Response The design utilizes an existing reactor vessel vent line which is capable of venting 48 hours of non-condensible gas buildup in less than one hour based on a 17% metal-water reaction.

Item 2. Additional venting capability is required for those portions of each hot leg that cannot be vented through the reactor vessel head vent or pressurizer. It is impractical to vent each of the many thousands of tubes in a U-tube steam generator; however, the staff believes that a procedure can be developed that assures sufficient liquid or steam can enter the U-tube region so that decay heat can be effectively removed from the RCS. Such operating procedures should incorporate this consideration.

Response The design provides sufficient venting of non-condensible gases to allow effective cooling of the RCS. The loop A&B hot legs vent to the pressurizer, which is provided with a venting system. The loop C hot leg is not vented to the pressurizer. However, since circulation is required through only one steam generator to provide cooling, venting of loop A&B hot legs provides sufficient redundancy. The station will incorporate the reactor vessel head vent design in either existing or new operating procedures.

Item 3. Venting of the pressurizer is required to assure its availability for system pressure and volume control. These are important considerations, especially during natural circulation.

Response The pressurizer currently provides venting capability through the pressure operated relief valves and safety valves. The newly provided pressurizer head vent allows greater venting control by providing a much smaller line for gas relief.

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ENCLOSURE 3