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July 14, 1981

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

Reference: (a) License No. DPR-3 (Docket No. 50-29)

Subject: TMI Action Plan Item II.B.1 - Reactor Coolant System Vents

Dear Sir:

Attached please find our responses to the Staff's positions and clarifications for TMI Action Plan (NUREG-0737) Item II.B.1 - Reactor Coolant System Vents. The information provides a description and sketch of the system design and responds to the criteria and requirements imposed by the Action Plan.

We trust this information is satisfactory; however, if you have any questions, please contact us.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

J. A. Kay

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Senior Engineer - Licensing

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Attachment

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ATTACHMENT

II.B.1 REACTOR COOLANT SYSTEM VENTS

Position

(1) Submit a description of the design, location, size, and power supply for the vent system along with results of analyses for loss-of-coolant accidents initiated by a break in the vent pipe. The results of the analyses should demonstrate compliance with the acceptance criteria of 10 CFR 50.46.

Response:

A flow diagram for the reactor coolant system vent system (RCSVS) is attached as Sketch A. The system adds the capability to vent the reactor vessel head or the pressurizer steam space.

Both vents tie into existing connections on the vessels. The reactor vent ties into the existing manual vent on the reactor head, while the pressurizer vent ties into the sample line on the power operated relief valve (PORV) connection to the pressurizer. Both vent lines are isolable from the vessels by existing manual valves.

Each of the new vent lines have been orificed at the connection to the existing lines. The orifice is sized so that a break in the vent pipe will result in a leak rate that is less than the makeup capacity of one charging pump. Therefore, a break in the vent pipe is not considered a loss-of-coolant accident and no new analyses are required to demonstrate compliance with the acceptance criteria of 10 CFR 50.46.

After the flow restricting orifice, each vent line contains two (2) motor operated valves (MOVs) in series, a vent valve and a block valve. Two valves in series are utilized to allow terminating the venting process in the event of a failure of one valve to close. The two vent paths are cross-connected after the first MOV. The reason for this will be covered below in the description of power supplies. The discharges of both vent valves are tied into the discharge piping of the PORV. This will allow for the collection of any leakage by the vent valves or any small discharges in the low pressure surge tank (LPST). Any large releases will be released to the containment atmosphere via the rupture disk in the line. (See Sketch A.)

The reactor vent valve and pressurizer block valve are powered from the same emergency motor control center (MCC). The reactor block valve is powered from the other emergency MCC. The pressurizer vent valve is powered from a nonemergency MCC, which is powered by the same emergency diesel that supplies the reactor block valve MCC in the event of a loss of off-site power. Therefore, in the event of a loss of off-site power, the vent and block valves in each vent path are powered from different emergency diesels. In case of a failure of one of these diesel power supplies, the RCSVS can still function with the two MOVs powered from the remaining power supply utilizing the cross-connect piping.

(2) Submit procedures and supporting analysis for operator use of the vents that also include the information available to the operator for initiating or terminating vent usage.

Response:

Procedures for the operation of the vents will be prepared prior to making the system operational. At that time, the procedures will be available for NRC review.

Clarification

A. General

(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.

(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 50.56.

Response

See response above to Position (2).

(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

The main criteria used for sizing the RCSVS was to insure that in the event of an inadvertent actuation, the leak rate was within the capabilities of the normal makeup system. Therefore, an inadvertent actuation of the vent system would not constitute a LOCA.

Once this was accomplished, the vent rate for noncondensible gases was determined. Based on the volume of noncondensible gases generated from a 100% Zr - H_2O reaction, this system would vent these gases in less than one (1) hour.

Based on this criteria, the sizing of the system was judged to be adequate for both concerns; LOCA and noncondensible gas vent rate.

(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

The reactor and pressurizer vent lines have been orificed such that in the event of an inadvertent opening of the vent the resulting leak rate will be within the makeup capacity of one charging pump. An inadvertent opening of a vent will not constitute a LOCA as defined in 10 CFR 50, Appendix A, and will not result in ECCS actuation.

Each vent path contains a block valve to prevent a prolonged venting process due to a stuck open vent valve.

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

Response

Positive indication of valve position will be provided in the control room.

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

Response

The RCSVS will be operable from the control room.

(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

The RCSVS meets the requirements for the reactor pressure boundary. As mentioned above, the vent lines are orificed so that the vents are smaller than the LOCA definition of 10CFR50, Appendix A. The probability of an inadvertent actuation of the system has been minimized by the following design features:

1. Each vent path contains two MOVs in series, therefore requiring the inadvertent operation of two valves to actuate the system.

2. Operation of the RCSVS will be administratively controlled by the control room supervisor.

3. The control switches for the four valves will be key-locked switches with the keys controlled by the control room supervisor.

(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

Each vent path contains two MOVs in series. Therefore, when it is desired to terminate venting from a vent path, only one of the two valves must function to terminate venting.

The two valves in each vent path can be powered from different emergency power supplies (see the response to Position 1). These valves are not subject to common mode failures. Furthermore, a single failure within the power and control aspects of the RCSVS will not prevent isolation of the system when required.

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

Response

For releases within containment, the area being released to will provide good mixing with containment air.

(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 RCSVS piping is seismically supported. All equipment, where possible, was purchased with both seismic and environmental qualifications. In some cases, equipment purchased is presently undergoing qualification testing, and was purchased as the best available. In other cases, equipment had to be purchased as the best available to be compatible with existing electrical equipment.

(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

The design will incorporate provisions for testing in accordance with subsection IWV of Section XI of the ASME Code for Category B valves.

(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

This design adds control switches with position indicating lights on the main control board. The section of the control board chosen for the location of this equipment was chosen for two reasons:

(a) the indications needed for venting are in close proximity, and

(b) the section of the control board presently requires only infrequent operator actions.

The other concerns mentioned will be considered during procedure preparation and operator training.

B. BWR Design Considerations

Not applicable.

C. PWR Vent Design Considerations

(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 capability to vent the reactor vessel head is provided. This vent is capable of venting noncondensible gases from the reactor vessel hot legs and cold legs.

(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 required procedure will be prepared prior to making the system operational. At that time, this procedure will be available for NRC review.

(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 capability to vent the pressurizer is included in the RCSVS to meet this concern.

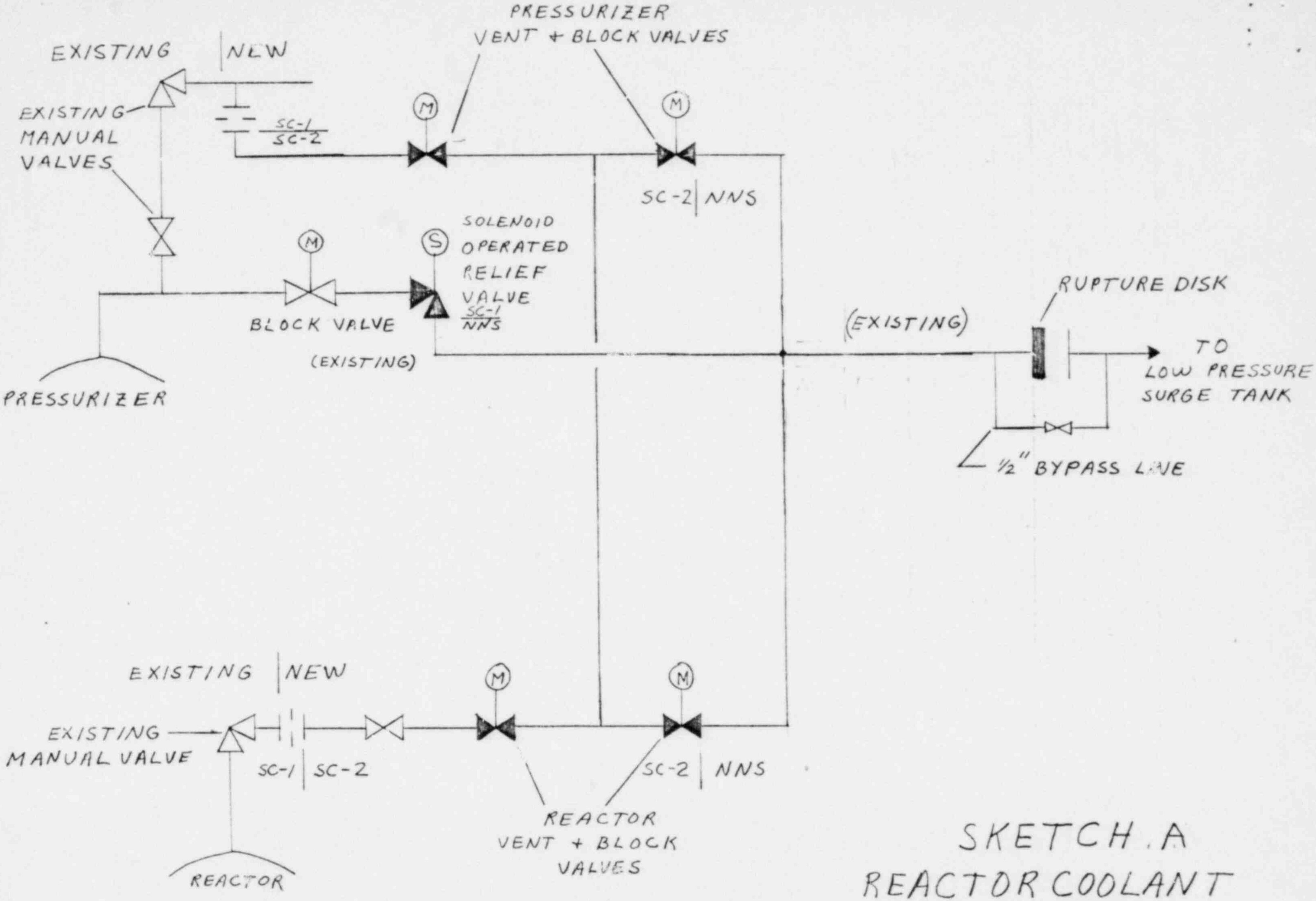
Additional Documentation

Supporting information including logic diagrams, electrical schematics, piping and instrumentation diagrams, test procedures, and Technical Specifications.

Response

The need for Technical Specification changes is being evaluated; however, at this time, no changes are anticipated.

Information, in support of the design change, will be available at the plant for NRC review.



SKETCH A

REACTOR COOLANT SYSTEM VENT SYSTEM