GULF STATES UTILITIES COMPANY

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File Nos. G9.5, G9.19.2,
G9.32

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

River Bend Station - Unit 1
Docket No. 50-458

The attached response provides additional information requested in a letter dated November 9, 1984 from Mr. A. Schwencer to Mr. W. J. Cahill, Jr. concerning TMI Action Plan Item II.D.1, "Performance Testing of Boiling-Water Reactor Relief and Safety Valves". Justification is provided for the applicability of the BWR Owners Group generic safety/relief valve (SRV) operability test results to the specific S/RV design employed at River Bend Station.

Sincerely,

J. E. Booker

J. E. Booker
Manager-Engineering,
Nuclear Fuels & Licensing
River Bend Nuclear Group

JEB/RJK/je

Attachment

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NRC QUESTION 1

The test program utilized a "rams head' discharge pipe configuration. River Bend Station (RBS) utilizes a X quencher configuration at the end of the discharge line. Describe the discharge pipe configuration used at RBS and compare the anticipated loads on valve internals in the RBS configuration to the measured loads in the test program. Discuss the impact of any differences in loads on valve operability.

RESPONSE TO QUESTION 1

The safety/relief valve discharge piping configuration at RBS utilizes a X quencher at the discharge pipe exit. The average length of the sixteen (16) S/RV discharge lines (SRVDL) is approximately eighty-eight (88) feet and the submergence length in the suppression pool is approximately fourteen (14) feet. The longest RBS S/RV discharge line is less than 112'. The S/RV test program utilized a ramshead at the discharge pipe exit, a pipe length of 112' and a submergence length of approximately 13'. Loads on valve internals during the test program are larger than loads on valve internals in the RBS configuration for the following reasons:

1. No dynamic mechanical load originating at the X quencher is transmitted to the valve in the RBS configuration because there is at least one anchor point between the valve and the X quencher.

2. The first length of the segment of piping downstream of the SRV in the test facility was approximately equal to the RBS piping, thereby resulting in a bounding dynamic mechanical load on the valve in the test program due to the larger moment arm between the S/RV and the first elbow. The first segment length in the test facility is 12 feet and the RBS plant configuration is approximately twelve (12) feet in length.

3. Dynamic hydraulic loads (backpressure) are experienced by the valve internals in the RBS configuration. The backpressure loads may be either (i) transient backpressures occurring during valve actuation, or (ii) steady-state backpressures occurring during steady-state flow following valve actuation.

   (a) The key parameters affecting the transient backpressures are the fluid pressure upstream of the valve, the valve opening time, the fluid inertia in the submerged SRVDL and the SRVDL air volume. Transient backpressures increase with higher upstream pressure, shorter valve opening times, greater line submergence, and smaller SRVDL air volume. The transient backpressure for the alternate shutdown cooling mode of operation is always much less than the design for steam flow conditions because of the lower upstream pressure and the longer valve opening time. The transient backpressure in the test program utilized a submergence length of 13', which is less than RBS, and a pipe length of 112' which is greater than RBS. The maximum transient backpressure occurs with high pressure steam flow conditions.

(b) The steady-state backpressure in the test program was maximized by utilizing an orifice plate in the SRVDL above the water level and before the ramshead. The orifice was sized to produce a backpressure greater than that calculated for any of the RBS SRVDL's.

The differences in the line configuration between the RBS plant and the test program as discussed above results in the loads on the valve internals for the test facility are expected to bound the actual RBS loads. An additional consideration in the selection of the ramshead for the test facility was to allow more direct measurement of the thrust load in the final pipe segment. Utilization of a X quencher in the test program would have required quencher supports that would unnecessarily obscure accurate measurement of the pipe thrust loads. For the reasons stated above, differences between the SRVDL configurations in RBS and the test facility will not have any adverse effect on S/RV operability at RBS relative to the test facility.

NRC QUESTION 2

The test configuration utilized no spring hangers as pipe supports. Plant specific configurations do use spring hangers in conjunction with snubber and rigid supports. Describe the safety relief valve pipe supports used at RBS and compare the anticipated loads on valve internals for the RBS pipe supports to the measured loads in the test program. Describe the impact of any differences in loads on valve operability.

RESPONSE TO QUESTION 2

The RBS safety-relief valve discharge lines (SRVDL's) are supported by a combination of snubbers, rigid supports, and spring hangers. The locations of snubbers and rigid supports at RBS are such that the location of such supports in the BWR generic test facility prototypical, i.e., each case (RBS and the test facility) there are supports near each change of direction in the pipe routing. Most SRVDL's at RBS have 1 spring hanger while one has 2 and one has no spring hangers, all of which are located in the drywell. The spring hangers, snubbers, and rigid supports were designed to accommodate combinations of loads resulting from piping dead weight, thermal conditions, seismic and suppression pool hydrodynamic events, and a high pressure steam discharge transient.

The dynamic load effects on the piping and supports of the test facility due to the water discharge event (the alternate shutdown cooling mode) were found to be significantly lower than corresponding loads resulting from the high pressure steam discharge event. As stated in NEDE-24988-P, this finding is considered generic to all BWR's since the test facility was designed to be prototypical of the features pertinent to this issue.

During the water discharge transient there will be significantly lower dynamic loads acting on the snubbers and rigid supports than during the steam discharge transient. This will more than offset the small increase in the dead load on these supports due to the weight of the water during the alternate shutdown cooling mode of operation. Therefore, design adequacy of the snubbers and rigid supports is assured as they are designed for the larger steam discharge transient loads.

This question addresses the design adequacy of the spring hangers with respect to the increased dead load due to the weight of the water during the liquid discharge transient. As was discussed with respect to snubbers and rigid supports, the dynamic loads resulting from liquid discharge during the alternate shutdown cooling mode of operation are significantly lower than those from the high pressure steam discharge. Therefore, it is believed that sufficient margin exists in the RBS piping system design to adequately offset the increased dead load on the spring hangers in an unpinned condition due to a water filled condition. Furthermore, the effect of the water dead weight load does not affect the ability of SRVs to open to establish the alternate shutdown cooling path since the loads occur in the SRVDL only after valve opening.

NRC QUESTION 3

The purpose of the test program was to determine valve performance under conditions anticipated to be encountered in the plants. Describe the events and anticipated conditions at RBS for which the valves are required to operate and compare these plant conditions to the conditions in the test program. Describe the plant features assumed in the event evaluations used to scope the test program and compare them to plant features at RBS. For example, describe high level trips to prevent water from entering the steam lines under high pressure operating conditions as assumed in the test event and compare them to trips used at RBS.

RESPONSE TO NRC QUESTION 3

The purpose of the S/RV test program was to demonstrate that the Safety Relief Valve (S/RV) will open and reclose under all expected flow conditions. The expected valve operating conditions were determined through the use of analyses of accidents and anticipated operational occurrences referenced in Regulatory Guide 1.70, Revision 2. Single failures were applied to these analyses so that the dynamic forces on the safety and relief valves would be maximized. Test pressures were the highest predicted by conventional safety analysis procedures. The BWR Owners Group, in their enclosure to the September 17, 1980 letter from D. B. Waters to R. H. Vollmer, identified 13 events which may result in liquid or two-phase S/RV inlet flow that would maximize the dynamic forces on the safety and relief valve. These events were identified by evaluating the initial events described in Regulatory Guide 1.70, Revision 2, with and without the additional conservatism of a single active component failure or operator error postulated in the event sequence. It was concluded from this evaluation that the alternate shutdown cooling mode is the only expected event which will result in liquid at the valve inlet. Consequently, this was the event simulated in the S/RV test program. This conclusion and the test results applicable to RBS are discussed below.

The alternate shutdown cooling mode of operation is the only expected event which will result in liquid or two-phase fluid at the S/RV inlet. Consequently, this event was simulated in the BWR S/RV test program. At RBS, this event involves an initial flow of subcooled water (less than 50^{O}F subcooled) at a pressure of approximately less than 135 psig. GSU believes the test conditions envelope these plant conditions.

As discussed above, the BWR Owners Group evaluated transients including single active failures that would maximize the dynamic forces on the safety relief valves. As a result of this evaluation, the alternate shutdown cooling mode is the only expected event involving liquid or two-phase flow. Consequently, this event was tested in the BWR S/RV test program. The fluid conditions and flow conditions tested in the BWR Owners Group test program conservatively envelope the RBS plant-specific fluid conditions expected for the alternate shutdown cooling mode of operation.

NRC QUESTION 4

Describe how the values of valve C_v's in report NEDE-24988-P will be used at RBS. Show that the methodology used in the test program to determine the value C_v will be consistent with the application at RBS.

RESPONSE TO NRC QUESTION 4

The flow coefficient, C_v, for the Crosby (8 x R x 10) Style HB-65-DF safety relief valve (S/RV) utilized at RBS was determined in the generic S/RV test program (NEDE-24988-P). The average flow coefficient calculated from the test results for the Crosby (8 x R x 10) Style HB-65-DF is reported in Table 5.2-1 of NEDE-24988-P. This test value has been used by Gulf States Utilities Company to confirm that the liquid discharge flow capacity of the RBS S/RV's will be sufficient to remove core decay heat when injecting into the reactor pressure vessel (RPV) in the alternate shutdown cooling mode. The C_v value determined in the S/RV test demonstrates that the RBS S/RV's are capable of returning the flow injected by the RHR or CS pump to the suppression pool.

If it were necessary for the operator to place the RBS plant in the alternate shutdown cooling mode, he would assure that adequate core cooling was being provided by monitoring the following parameters: RHR or CS flow rate, reactor vessel pressure and reactor vessel temperature.

The flow coefficient for the Crosby (8 x R x 10) Style HB-65-DF valve reported in NEDE 24988-P was determined from the SRV flow rate when the valve inlet was pressurized to approximately 250 psig. The valve flow rate was measured with the supply line flow venturi upstream of the steam chest. The C_v for the valve was calculated using the nominal measured pressure differential between the valve inlet (steam chest) and 3' downstream of the valve and the corresponding measured flowrate. Furthermore, the test conditions and test configuration were representative of RBS plant conditions for the alternate shutdown cooling mode, e.g. pressure upstream of the valve, fluid temperature, friction losses and liquid flow rate. Therefore, the reported C_v values are appropriate for application to the RBS plant.