Consumers Power Company

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December 30, 1985

Director,
Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
TMI ACTION PLAN ITEM II.D.1 - PERFORMANCE TESTING OF
RELIEF AND SAFETY VALVES - ADDITIONAL INFORMATION

By letter dated August 6, 1985, the NRC staff requested additional information on TMI Action Plan Item II.D.1 - Performance Testing of Relief and Safety Valves. Response was requested within sixty days of the receipt of the request unless other arrangements were made with the Palisades Project Manager. Verbal agreement by the Project Manager to allow Consumers Power Company until the end of 1985 to respond was recorded by a Consumers Power submittal dated October 2, 1985. The following are the staff questions as stated in the August 6, 1985 NRC letter and the Consumers Power Company response.

1. Question:

The Combustion Engineering Report on operability of PORVs in CE Plants indicated that the limiting inlet fluid conditions during low temperature pressurization transients is a water discharge event. The CE Inlet Fluid Conditions report stated that the pressurizer water solid condition and resulting PORV liquid discharge case was chosen for the cold over-pressurization event since it gave the most severe pressurization transients. The report further states that a steam bubble can also exist in the pressurizer during low temperature operation whereby the PORV could lift on steam. No low pressure steam tests were performed by EPRI on the Dresser PORV. Provide verification that the Palisades PORV will operate satisfactorily on low pressure steam.

Response:

Tests performed in the EPRI Testing Program confirmed the Dresser Type 31533VX Electromatic PORV will operate satisfactorily when high pressure steam or water or low pressure water are the inlet fluids. The Dresser

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PORV operates by the effect of the differential forces derived from differently sized affected areas on the top and bottom of the main disc being exposed to the same fluid medium. The clearances between valve parts which allow flow of that medium to both sides of the main disc and through the pilot valve are adequate to allow low pressure water flow and permit satisfactory valve operation. This fact is substantiated by Wyle PORV Test Results for Tests 12-DR-3W and 14-DR-3W as reported in Reference 2 and envelope the necessary conditions to allow low pressure steam flow and make the low pressure steam testing of the valve unnecessary.

2. Question:

The Palisades nuclear plant utilizes a Dresser 31533VX PORV valve. The model number indicates that the valve contains the older obsolete internals. Most plants using this valve have upgraded their valves to the type 2 internals. The EPRI tests were conducted with the type 2 internals. The EPRI PWR Safety and Relief Valve justification report indicates that as of August 1982 the licensee had not purchased the parts necessary to upgrade their valves to the type 2 internals. The manufacturer indicated that all plants using this valve are expected to make the modification. Provide verification that the modification has been made for the Palisades valves or, if the modification has not been made, provide justification that tests are applicable and adequately demonstrate acceptable performance of the plant valves.

Also, based on information obtained on other plants, the manufacturer recommends that a heavier spring be installed in both the main valve and the pilot valve in order to prevent leakage at lower pressures. Provide verification that this modification has been made or other information which demonstrates the valve will not excessively leak causing valve seat damage during low pressure fluid inlet conditions.

Response:

The modifications to install type 2 internals and to install heavier springs in the Palisades PORVs have not been made because they are not necessary. As stated in Reference 1, the type 2 internals modification was designed to improve main valve seat tightness, but has the disadvantage of reducing the permissible back pressure against which the valve can discharge. Reference 1 continues to state "it can be shown analytically that the type 2 design is most restrictive and that any test data can be transferred to other models with complete confidence of their qualification."

As long as operation has been restricted to LTOP conditions, Palisades has not had a main valve seat leakage problem; therefore, there is no reason to install type 2 internals.

Heavier main valve and pilot springs were recommended to prevent low pressure leakage. As stated in the previous paragraph, low pressure leakage has not been a problem at Palisades. There is no reason to install heavier springs.

3. Question:

The submittal states that the ring settings used on the Palisades Safety Valves (-45, -30, -2) are not the same as any of those used in the EPRI tests. It further states that the EPRI tests were used to correlate the effect of ring settings on valve lift and blowdown and from this it was determined that the existing ring settings are acceptable. Provide information on how the test data were used to perform the correlation and provide assurance that the correlation provides assurance of the stable operation of the valves.

Response:

The test data used to correlate the Palisades Safety Valve performance and its ring settings is the data listed in Table 3.1.1 of Reference 2. A preliminary graph of % Rated Lift vs % Rated Flow using data from all the tests in which steam was the operating medium was made and results indicated a strong correlation between % Rated Flow and % Rated Lift up to 85% Rated Lift. At higher values of rated lift, a correlation was indicated but had a different relationship than for tests with less than 85% rated lift.

Using data from tests which did not produce lifts of more than 85% of rated lift and did not involve a wet loop seal, a plot was made of % Rated Lift vs % Rated Flow. (This is appropriate for Palisades since the lift of the Palisades Safety Valves is mechanically stopped at .350" instead of the usual rated .450" and the flow area is restricted to 78% of the normal rated flow area.) Using the Least Square Linear Regression (LSLR) method, a relationship with a very high correlation coefficient was determined.

Next, again using the LSLR method, a relationship between Ring Setting and % Rated Flow was established. The relative position of the middle ring, the lower ring and the valve seat effects the amount of lift. The upper ring position determines how quickly the valve will be effected by back pressure. It is the overlap of the bottom of the middle ring over the top of the lower ring or the valve seat, whichever is higher, that determines lift. The overlap dimension is measured in notches and given the label "Delta Ring Setting" (ΔRS). Using data from seven tests which had backpressure higher than that calculated for Palisades (for conservatism), operated in a steam medium, used the "C" or short inlet and produced lifts of less than 85% of rated; ΔRS was plotted versus % Rated Lift. A good correlation exists. A lift of 55% of Rated Lift corresponds to the Palisades ΔRS of 30 notches. (The middle ring at Palisades is set at -30 and the lower ring at -2. Therefore the ΔRS for Palisades is the distance, 30 notches, from the bottom of the middle ring

to the valve seat. The lower ring, being set at -2, did not effect this determination.)

55% of Rated Lift corresponds to 80% Rated Flow. 80% Rated Flow is 238,000 lb/hr or 104% of the Palisades FSAR rated flow. Therefore, it can be assumed with a high level of confidence that the Palisades SV ring settings will permit adequate flow.

ΔRS was then plotted vs % Blowdown using results from the same seven tests as were used for the ΔRS vs % Rated Lift correlation. At the Palisades middle ring setting of -30, a blowdown of 7.6% is derived. A 7.6% blowdown at a middle ring setting of -30 is further verified by Figure B4-4 in Reference 2. Examination of the results of the EPRI Safety Valve Tests, indicates that stable valve operation, was obtained for blowdowns from 4.9% to 16.9%. The predicted Palisades blowdown is enveloped by these results.

4. Question:

The Palisades plant is the only one utilizing a Dresser PORV without a bellows. The EPRI valve selection justification report states the valve with bellows may be used with up to 500 psig backpressure and that the valve without bellows is for "No Back Pressure" applications. While the Palisades PORVs are used only for low temperature overpressure protection, there may be conditions in which there is significant backpressure on the PORV valves. Provide verifying information to demonstrate the backpressure on the PORVs in not a problem or has been accommodated.

Response:

As stated in Reference 1, the purpose of installing a bellows around the pilot stem is to prevent leakage along the pilot stem and does not effect valve operation. If there is a pilot stem leakage problem it can be prevented (up to 500 psig backpressure) with a bellows. Palisades has no problem with leakage along the pilot stem and has no reason to install the bellows.

5. Question:

The submittal indicates that the PORV block valves are closed during normal plant operating conditions such that the block valves (and the PORVs) are not challenged under full flow, high pressure and temperature fluid conditions. However, during the mitigation of some transients, the block valves may be opened to either reduce challenges to the safety valves or for depressurization of the primary system. There were no full size, full flow tests performed by EPRI on the plant model block valve.

Therefore, provide information which demonstrates that the block valves can be operated, closed and opened for all fluid conditions expected

under operating and accident conditions as required by NUREG-0737, Item II.D.1.

Response:

Palisades operates with the block valves closed and the Palisades Safety Analysis does not require operation of the block valves. However the Palisades Off Normal Procedures suggest use of the PORV's and block valves to initiate once through cooling if while attempting to initiate natural circulation a void preventing circulation cannot be eliminated by use of the HPSI pumps and head vents. More information in response to this question will be submitted later.

6. Question:

The submittal states the load combination used to evaluate the piping are based on the Final Safety Analysis Report (FSAR). The loads from safety or relief valves opening are considered to act separately from the seismic loads. This treatment is consistent with the recommendations of the "EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results" for the non-seismically designed downstream portion of the piping. The EPRI Guide, however, recommends that for piping upstream of the valves the loads from opening of the safety or relief valves be combined with seismic loads. Provide an assessment of the upstream portion of the piping for the combination of valve opening and seismic loads or provide justification for not considering the combination.

Response:

The Palisades safety and relief valve discharge piping analysis has been revised from that previously transmitted to the Staff. The revision was made to correct for information accumulated during the 1983 refueling outage. Certain refinements to the analysis model were also adopted. The basic valve operating times and load time history were not changed.

Load conditions were combined according to both Palisades FSAR and EPRI load combinations. Pipe stresses resulting from these load combinations were compared with stress allowables on a consistent basis. For this particular system, the EPRI criteria tended to be more liberal than a strict interpretation of the Palisades FSAR. This is true because seismic loads are low in this soft system and EPRI criteria increase the Palisades FSAR occasional load criteria allowable by 50 percent downstream of the safety valves.

For the system pipe stress analysis, all EPRI load combinations met EPRI acceptance criteria. Palisades FSAR criteria for the occasional load (safety valve discharge) were violated downstream of the safety valve. However, FSAR criteria ($1.2S_h$) were intended for safety related (upstream) rather than downstream portions of the piping. The EPRI allowable of $1.8S_h$ is judged more appropriate for downstream piping.

Therefore, it is concluded that the intent of the FSAR is met downstream as well as upstream. No violations of the EPRI criteria exist at any location upstream or downstream of the valves. Therefore, piping stresses are acceptable.

7. Question:

The submittal did not provide an evaluation of the loads on the pressurizer or quench tank nozzles. Provide an evaluation showing that the nozzle loads, considering the appropriate load combinations, are acceptable.

Response:

The basis for the entire pressurizer design is CENC-1114 - Analytical Report for Consumers Power Pressurizer, 1969. The design criteria for the pressurizer was per ASME Section III and certain code cases. The design specification included fourteen load combinations to include the effects of 200 safety valve operations. All or any part of that analysis is available for Staff review.

The nozzle analyses were conducted by rather detailed interaction analyses which were not intended to be revised for incorporation of new loads. The results of those analyses indicated a maximum primary plus secondary stress intensity range of 16.9KSI for the relief valve nozzle and 40.5KSI for the safety valve nozzle. The design limit was 69.9KSI. The maximum fatigue usage factor was determined to be .122. The analysis concluded that thermal gradient stresses and stresses due to gross structural discontinuities are of no significance.

To supplement the pressurizer nozzle analysis of the original design, rather simple pipe analysis was performed consistent with EPRI load combinations and acceptance criteria. All of the EPRI requirements were met. In addition, the stress components of this evaluation were reviewed in terms of the maximum principal stress differences of CENC-1114. It was concluded that allowables for primary plus secondary stress intensity range could include the added valve discharge loads and still meet $3S_m$. Fatigue usage is essentially unaffected.

The loading environment for the quench tank nozzle is somewhat more simple than that for the pressurizer. Analysis of the nozzle pipe implied conformance to EPRI and FSAR requirements. The nozzle/saddle weld was also evaluated and meets FSAR design requirements.

8. Question:

The submittal stated that several of the pipe supports were shown to have higher loads from the safety or relief valve discharge than were previously identified in response to the IE Bulletin 79-14. The submittal further stated that the Consumers Power Company intended to analyze the pipe supports to determine which supports were overloaded and

intended to modify these supports. Provide results of analysis identifying which supports are overloaded and provide a description of the modifications planned.

Response:

Piping support loads and deflections have been reviewed for purposes of evaluating snubber actuation, spring hanger bottoming and solid support overload. The most limiting supports with regard to FSAR criteria are the frame guides which are the first stiff supports downstream of the safety valves. A review of these supports concluded that one support required repair. That support is just downstream of safety valve RV1040.

The support failed FSAR criteria in that it did not have the section to resist bending. The support was a framed guide composed of channel members. The repair consisted of "closing" the channel sections by welding plate over the open sections requiring reinforcement. The bending section was increased substantially by adding plate.

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James L Kuemin
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CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

References

1. PWR Safety and Relief Valve Test Program Valve Selection/ Justification Report, EPRI NP-2292 Final Report dated December 1982.

2. EPRI PWR Safety and Relief Valve Test Program Safety and Relief Valve Test Test Report, EPRI NP-2628-LD, Interim Report dated September 1982.

3. CEN-227, Summary Report on the Operability of Pressurizer Safety Valves in C-E Designed Plants.

4. CEN-213, Summary Report on the Operability of Power Operated Relief Valves in C-E Designed Plants. June 1982.