Consumers Power Company

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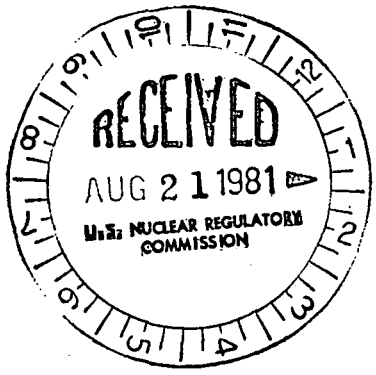


Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM

NRC letter of February 10, 1981 (received March 30, 1981) requested information sufficient to identify the extent to which the Auxiliary Feedwater (AFW) System at Palisades is seismically qualified. It requires that essentially three elements be addressed: (a) to identify what portions of the AFW System are seismically qualified; (b) for those portions considered qualified to describe the methodology upon which that conclusion is based, and; (c) to walkdown portions considered unqualified and using Enclosure 2 and judgement criteria to identify appropriate modifications to enhance the seismic reliability of the equipment.

Since the basic reviews and concerns upon which the present letter is based (Enclosures 2 and 3 to D.G. Eisenhut's October 21, 1980 letter) were completed in August of 1980, much work related to seismic qualifications at Palisades has been completed. Additional work is either planned or in progress as a result of this and other NRC programs.

In the fall of 1980, the Systematic Evaluation Program (SEP) was accelerated. Palisades was chosen by NRC as the lead plant. This focused the efforts of W. Russell's entire SEP staff on Palisades. Seismic review was a major item to be addressed in preparation for integrated assessment. NUREG/CR-1833, the report by Lawrence Livermore Laboratory on the Senior Seismic Review Team's (SSRT) review of Palisades was issued on January 19, 1981. The auxiliary feedwater system was given careful consideration by SSRT and was used as one of the examples in their confirmatory calculations.

The TMI Action Plan also focused on auxiliary feedwater. The Palisades system was modified to provide automatic initiation and control capability. To provide this capability as soon as possible, the controls were installed as "control grade". The new portions will be brought to safety grade standards, including seismic qualification, during the next refueling outage which will start soon. Additional modifications to the AFW system, including possible repiping of pump discharge or addition of pumps, are currently being considered to more rigorously meet the post TMI Action Plan requirements.

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As a result of the on-going SEP Program, Consumers Power decided to go well beyond minimum NRC requirements in responding to the 79-02, 79-04, 79-07, 79-14 series of piping related bulletins. All safety related piping systems in the plant were reanalyzed using present day seismic methodology and present day piping analysis computer codes. Modifications were made as necessary to meet Palisades FSAR criteria for load combinations and stress level. All piping was analyzed to the same criteria (class 1) if it was judged to be safety related.

As a result of concerns stemming from water hammer and thermal fatigue cracking in the main feedwater line, Consumers Power has decided to pipe auxiliary feedwater directly into the steam generators. This modification is scheduled to be installed during the upcoming refueling outage. The line extensions will be seismically designed.

Due to the above activities, the age of the plant, and the great change in the vernacular of the seismic design business in the 13 years since original licensing, it is very difficult to address Enclosure 1 and Table 1 of your February 10, 1981 letter on a yes/no basis. The following discussion is intended to address all of the points in these attachments and to provide the information that the NRC is asking for.

Enclosure 1 - First Paragraph - This paragraph relates to the definition of AFW System boundaries. By the NRC's definition, the system extends to the second valve which is normally closed or capable of automatic closure. At Palisades, the boundry extends to the first normally closed or the first valve capable of automatic closure. The second normally closed or automatic valve does not, in general, exist. The effects of branch lines to the first anchor were considered in analyzing the main pipe runs. The mechanical and electrical equipment required to operate the system is included. The instrument air system has not recently been reviewed for seismic design. Credit is taken for the failure position of the valves on loss of air or the ability to manually operate the valves on loss of air. Recently performed safety analysis determined when manual action is required and credit was taken for it.

The final boundry definition problem relates to water source. The condensate storage tank is the normal water source for the AFW system. This tank and the associated suction piping to the AFW pumps is seismic class 1. Per FSAR Section 9.7.2.1, it is designed to hold a minimum of 60,000 gallons which is the amount required to achieve cooldown in 8 hours. The technical specifications Section 3.5.1 require 100,000 gallons in the condensate storage tank and the primary makeup tank combined and a backup source from the fire system. In recent SEP safe shutdown reviews (NRC letter 11/5/80), the staff states that 107,000 gallons are required. Consumers Power Company pointed out (July 22, 1981 letter) that the NRC's assumptions upon which this requirement is based are very conservative. The primary makeup tank was not designed to be seismic class 1 and in the opinion of NRC's SSRT increased anchor capacity should be installed if the tank is essential to safety (NUREG/CR-1833 Pages 9 and 93). It is our position that sufficient water is maintained in the condensate storage tank (low level alarm set at 72,000 gal.) to take care of system cooling requirements until manual action can be taken to augment the supply from the fire system, service water system, or one of the many other tanks on site, some of which contain high quality water and were designed to resist earthquakes. The diesel fire pump and fire system cross tie were designed as seismic class 2 per Appendix A, Page A-3 of the FSAR (equivalent to OBE of 0.05 g's with no SSE analysis required). For these reasons, the system

boundry for water supply is difficult to define. It should be noted that although the condensate storage tank has a capacity of 125,000 gallons, some space must be reserved to accept condensate rejection on turbine trip. Failure to do so causes the tank to open at the roof line due to hydrostatic head from the condensate pumps and the large size of the condensate reject line. The rejected condensate would add to the tank inventory and be available as AFW supply, however, it is not in the tank during plant operation to meet tech. spec. requirements and the turbine cycle piping is, of course, not seismic class 1.

Enclosure 1 - Item A

The Palisades AFW System, in a general sense, meets seismic requirements by method (b) in that it is designed, constructed, and maintained to withstand a safe shutdown earthquake utilizing the analytical, testing, evaluation methods and acceptance criteria consistent with other safety-grade systems in our plant. The specific discussion for qualifying this general statement is as follows.

Original Plant Design

The FSAR Section 9.7, Auxiliary Feedwater System, states, "Equipment in the system required for safe shutdown following a loss-of-coolant accident is designed to seismic class 1 requirements." And, "The pumps are located in a tornado-proof seismic class 1 portion of the turbine building."

The FSAR Appendix A lists the Enclosure for the auxiliary feedwater pumps and supports for class 1 system components as class 1 structures. It lists the motor-driven auxiliary feedwater pump, condensate storage tank and associated piping along with control boards, switchgear, load centers, batteries and cable runs serving class 1 equipment as class 1 systems and equipment.

Appendix A of the FSAR lists the turbine-driven auxiliary feedwater pump including its auxiliary equipment and associated piping, the diesel driven fire pump including its auxiliary equipment and piping to the auxiliary feedwater system, and the plant instrument air system and associated piping as class 2 systems and equipment.

Piping Reanalysis Performed as a Result of IEB 79-02, 04, 07, 14 and Pending SEP Questions

As a result of continuing questions on piping analysis, difficulties in retrieving original analysis, and in light of pending SEP seismic review, Consumers Power decided in 1979 to reanalyze essentially all of the safety related piping using current methodology. The plant was out of service for nearly a year in 1979 and 1980 while this analysis and associated modifications to pipe supports were accomplished. This analysis used the original Palisades seismic input for class 1 (0.2 g SSE, 0.1 g OBE, Housner Spectrum) for all piping analyzed regardless of whether it was listed as class 1 or 2 in the FSAR. The auxiliary feedwater system piping was included in the effort. The AFW suction piping to the condensate storage tank (CST), piping between the CST and PMU tank, the AFW discharge piping from the pumps to the steam generators, and the steam lines from both generators to the turbine-driven AFW pump, the turbine exhaust, and the fire system cross tie to the diesel-driven fire pump were reanalyzed and supported as necessary. We conclude that this effort served to upgrade the piping associated with the Turbine-Driven AFW Pump and the Fire System Cross Tie from class 2 to class 1. One of the Two Redundant steam supply lines to the turbine-

driven AFW pumps runs through the turbine building. As reported in Section 8 of Amendment 17 to the Palisades License Application the turbine building was dynamically analyzed for Ground Acceleration of 0.20g (SSE). The results of that analysis showed the column stress levels to be below allowable and concluded that the building would not collapse and the crane would remain in place. Therefore, although the turbine building is not class 1, it is concluded that the building will not fall on the line and interfere with its Seismic Class 1 rating.

SYSTEMATIC EVALUATION PROGRAM (SEP) SEISMIC REVIEWS

The SEP Seismic Review included AFW as an important safe shutdown system. The scope of the SEP Seismic Review included all elements of your February 10, 1981 letter. One of the primary objectives of SEP is to compare plants to current criteria.

The SEP Review included inspection of systems and structures, site and office visits to review detailed working level documents, independent verfication calculations by NRC consultants, and approximately two years of interaction between us, our consultants, NRC, and NRC's consultants. The results of this review are documented in NUREG/CR-1833, its references, and supplements.

NRC's transmittal letter (D.M. Crutchfield to D.P. Hoffman, January 19, 1981) contained, as enclosure 2, a list of open items and a request for a plan of resolution. Our letter to NRC dated March 27, 1981 provided comments on the report and an outline of actions and schedule to resolve the enclosure 2 items. As a result of this action we are essentially requalifying both AFW pumps. The effort is scheduled to be complete in September 1981. When finished the Mechanical Qualification of the AFW System to Palisades class 1 criteria will be completed.

The AFW System at Palisades is powered off a Class 1-E Bus. The electrical controls are covered as Seismic Class 1 in the original plant design. The entire electral portion of the AFW System is a subset of the electrical equipment reviewed in SEP. NUREG/CR-1833 discusses the electrical equipment but leaves the functionality question open. Items 11 through 15 of our March 27, 1981 letter discuss our plan to resolve the electrical euqipment. In summary, the AFW electrical was listed as Seismic Class 1 in the FSAR. The adequacy of the original design in light of present day knowledge and criteria is being reviewed in SEP. To the extent that deficiencies are identified they will be resolved under the SEP program. Recent modifications to AFW made per the post TMI Action Plan either are Seismic Class 1 or will soon be modified to meet Class 1 criteria.

Application Of Seismic Related IEB 79-02, 79-04, 79-07, 79-14, 80-11 and IE Information Notices 80-21 To The Palisades AFW System

Bulletins 79-04 and 79-07 were found to not be problems at Palisades. Bulletins 79-02 and 79-14 were applied to the AFW Piping including the steam lines to the turbine driven pump. They were applied to the Fire Header in the screen house which is listed in the FSAR as Seismic Class 2 piping and is a backup water source to the condensate and primary makeup tank sources. Bulletins 79-14 and 79-02 were not applied to the instrument air system piping which is also listed as Seismic Class 2.

Bulletin 80-11 was applied to the AFW system. The redundant steam line

EBD-6-4" from steam generator E-50A to the turbine driven AFW pump runs through the turbine building where it goes within falling distance of a block wall. This is considered acceptable since the line from E-50B is available as is the motor driven pump.

IE information notice 80-21 was not applicable to Palisades since Palisades was a part of the reason for the notice. The issue was covered by the January 1980 NRC letter referenced in the notice. The AFW System was considered as Safety Related and was covered by work associated with the January 1980 letter. Our July 22, 1981 letter contains our final responses to the January 1980 letter.

AFW System Walkdowns

NRC's Senior Seismic Review Team in evaluating Palisades walked the site. Because of the Post TMI Action Plan the AFW System was given particular attention. It was chosen in every possible instance as the example system to be calculated or evaluated. Our consultants from Bechtel Corp accompanied the SSRT as did NRC staffers. Subsequent walkdowns associated with electrical equipment tie-down and the SEP owners group's cable tray program were conducted, by URS/John A. Blume Associates. The piping was walked, mapped for as-built condition, analyzed, and rewalked for verification during our efforts related to IEB 79-14. The results of SSRT's efforts are documented in NUREG/CR-1833, in our letter of March 27, 1980, and in supplements to report EGG-EA5317. The Blume results were transmitted in our letter of July 22, 1981.

Due to the large number of previous walkdowns, the level of expertise involved in previous walkdowns, and the large amount of time spent walking systems, an additional walkdown was not performed specifically for the purpose of the February 10, 1981 NRC letter.

Discussion Of Equipment Which May Not Be Qualified To Withstand SSE Utilizing Evaluation Criteria Consistent With Other Safety - Grade Systems In The Plant.

Table 1

Equipment not presently fully seismically qualified to SSE levels.

1. Pumps/Motors - Turbine driven AFW pump. Listed in FSAR as Class 2 - being evaluated as Class 1 in SEP. Class 1 level qualification analysis expected to be complete approximately September 1981.

2. Piping - Steam lines to turbine driven AFW. Listed as Class 2 in FSAR. Was evaluated as Class 1 in analysis related to IEB 79-14. Line stress levels and pipe hangers now meet Class 1 criteria for Palisades. One of the two redundant lines goes through the Non-Class 1 turbine building (see #8 below). Statements on AFW piping in NUREG/CR-1833 p. 12 have been revised based on a supplement to EGG-EA-5317. The original EGGs work did not consider the full as-built piping arrangement.

3. Valves/Actuators - Credit is taken for manual backup actuation of steam supply valves and pressure regulation of steam to the turbine driven AFW pump in the event that the instrument air system fails.

4. Power Supplies

5. Primary Water and Supply Path - Condensate storage tank and path to AFW pump is qualified but may contain as little as 60,000 gal. of the 100,000 gal. required by tech. specs. The remaining 40,000 gal. may be in the primary makeup (PMU) tank T-81. T-81 is not seismically specified and qualified. SEP review of T-81 (NUREG/CR-1833 Pg. 9) found that tank would need increased anchor capacity in order to survive SSE. The line from T-81 to the condensate storage tank has been analyzed to Class 1 criteria.

6. Secondary Water and Supply Path - Technical specifications require a secondary water supply from the fire system. FSAR Appendix A lists this system as seismic Class 2. The piping has been reanalyzed in the 79-14 work to Class 1 criteria. The pipe supports were also redone to Class 1 criteria. No attempt was made to reanalyze or upgrade the fire pumps. There are, however, two diesel pumps, one electric fire pump, and three service water pumps available. The service water cross tie to the fire system was reanalyzed as Class 1. The service water pumps are Class 1. SEP review has raised questions on the Service Water pumps. These are being addressed by requalifying the pumps. The effort should be completed in September 1981.

   Additional backup water is available in tanks T-90 and T-91. These tanks were purchased to meet Seismic Class 1 requirements. The piping required to deliver the water to AFW pump suction may not be seismic Class 1 and may not be large enought to meet peak demand.

7. Initiation and control system. An automatic initiation & control system has recently been added to the previous remote manual system. The new automatic controls do not necessarily meet full Class 1E criteria. They will be upgraded to Class 1E and hence seismic Class 1 criteria during next refueling outage.

   Instrument air is required to remote manually or automatically run the AFW system. Failure mode on loss of air and/or local manual override and bypass capability, however, allow the system to function in the event air is lost.

8. Structures supporting or housing these AFW System Items. One of the two Redundant steam supply lines to the Turbine Driven AFW Pump runs through the Turbine building which is not seismic Class 1. The turbine building has, however, been analyzed for the original plant SSE (0.2g Housner spectra). It was found that the building will not collapse and that the crane will remain in place. The building will, therefore, not fall on the line and its transit through the turbine building is acceptable.

In summary we conclude that the entire AFW system at Palisades either presently or within the next several months will meet seismic Class 1 requirements. All shortcomings have been identified in other programs. All appropriate fixes have been or will be accomplished through these same programs. We have concluded that no additional corrective action need be taken.

Enclosure 1 Item B - Methods and Acceptance criteria used to support the conclusion of seismic qualification. The methodology and acceptance criteria used to support conclusions of seismic qualification at Palisades have been extensively reviewed by NRC under the SEP program. The results of that review are published in NUREG/CR-1833 and its references. It is our understanding that the

NRC staff has concluded that the original seismic design criteria and methodology have been shown by independent review and confirmatory calculations to be adequate. There are efforts underway as outlined in our March 27, 1981 letter to address those areas which were reserved from the above conclusion due to our having produced insufficient information for NRC and its consultants to make a judgement.

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