UNION ELECTRIC

1901 Gratiot Street, St. Louis

Donald F. Schnell
Vice President

September 18, 1987

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Gentlemen: ULNRC-1618

DOCKET NUMBER 50-483
CALLAWAY PLANT
RESPONSES TO QUESTIONS ON
CALLAWAY PLANT UPRATING

References:
1) ULNRC-1471 dated March 31, 1987
2) ULNRC-1494 dated April 21, 1987
3) NRC letter dated August 5, 1987 from T. W. Alexion to D. F. Schnell
4) ULNRC-1470 dated March 31, 1987
5) ULNRC-1535 dated June 18, 1987

References 1 and 2 transmitted the license application and additional supporting information for the Callaway plant uprating. Attached to this letter are responses to your request for additional information transmitted by Reference 3.

Reference 4 transmitted the reload license application for Callaway Cycle 3. In Reference 5, a revision to the Technical Specifications dealing with ΔT_o and the associated bases were transmitted. With approval of these changes in the Callaway Cycle 3 amendment, there will be no changes necessary for the specification on ΔT_o for the Callaway uprating. Therefore, please disregard the changes requested on pages 2-7 and 2-9 which were contained in Attachment 2 of Reference 1.

If there are any further questions, please contact us.

Very truly yours,

Robert J. Schukai
for Donald F. Schnell

KGC/mat

Attachment

Drawings To: Reg Files
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STATE OF MISSOURI)
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CITY OF ST. LOUIS)

Robert J. Schukai, of lawful age, being first duly sworn upon oath says that he is General Manager-Engineering (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Robert J. Schukai
Robert J. Schukai
General Manager-Engineering
Nuclear

SUBSCRIBED and sworn to before me this 18th day of September, 1987.

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1989
ST. LOUIS COUNTY

cc: Gerald Charnoff, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, N.W.
Washington, D.C. 20037

Dr. J. O. Cermak
CFA, Inc.
4 Professional Drive (Suite 110)
Gaithersburg, MD 20879

W. L. Forney
Chief, Reactor Project Branch 1
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Bruce Little
Callaway Resident Office
U.S. Nuclear Regulatory Commission
RR#1
Steedman, Missouri 65077

Tom Alexion (2)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop 316
7920 Norfolk Avenue
Bethesda, MD 20014

Ron Kucera, Deputy Director
Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Manager, Electric Department
Missouri Public Service Commission
P.O. Box 360
Jefferson City, MO 65102

RESPONSES TO QUESTIONS ON CALLAWAY PLANT UPRATING

1. You stated in your submittal that:

   a) It was concluded that, with the exception of the turbine-generator system, they (BOP systems) have the capability to function properly at the uprated power level of 3579 MWt NSSS power without any modifications to the existing design.

   b) The turbine-generator system is designed to operate at 3562 MWt power. The performance of the system will be monitored closely by Union Electric (U.E.) between 3562 MWt and 3579 MWt power.

   Provide the results of the reanalysis which demonstrates that the power uprating will not affect the previous staff approval of the plant turbine missile protection. In this regard, verify that the turbine over-speed protection system provides adequate control <u>under all operating conditions</u> and will assure that a full-load turbine trip will not cause the turbine to overspeed beyond acceptable limits which could result in turbine missiles.

<u>Response</u>

The previous NRC staff approval of the turbine missile protection for Callaway plant was based on the low probability of any damage to a safety-related component. The lifetime probabilities (before uprating) were given by GE to be 1.5×10^{-7} for the high speed (runaway) case and 1×10^{-9} for the low speed case. The order of magnitude of these probabilities will not change after uprating to 3579 MWt because:

a) There will be no increase in steam pressure inside the turbine, and

b) The turbine-generator is already designed for 3562 MWt. Therefore, the increase in its operating power is very small (less than 0.5 percent).

Also, the turbine generator for Callaway has an overspeed protection system employing electro-hyrdraulic controls (EHC). These EHC's are extremely reliable employing three electrical and one mechanical speed inputs. Logic signals are processed in both electronic and hydraulic channels for redundancy. As per FSAR Section 3.5.1.3, there have been no runaways of General Electric turbines equipped with EHC. Since there have been no modifications made to the turbine due to uprating, the overspeed protection will work as designed prior to uprating. That is, even after uprating, a full-load turbine trip will not cause the turbine to overspeed beyond acceptable limits.

Based on the above, it was concluded that missiles from the turbine would not be a problem after uprating.

2. You stated in you main feedwater system (MFS) evaluation that:

   a) At an uprated level, the feedwater system will see a rise in temperature of 1.5 degrees F and a flow increase of less than 1 percent from the previous valve wide open (VWO) design flow.

   b) The effect of such a small increase in flow on the flow velocities, system pressure drop and the high pressure heater performance will be negligible. For the small change in flow, there will be no impact on the performance of the pumps. These pumps, including their turbine drivers, have sufficient capacity to produce the uprated flow.

   Provide assurance that the safety related portion of the MFS piping and the MFS isolation valves can withstand the uprated conditions and continue to perform their safety function.

Response

The safety-related portion of the Main Feedwater System (MFS) piping (inside containment and isolation valve compartment) has been designed conservatively for a temperature of 450 degrees F and pressure of 1185 psig. After uprating, the feedwater temperature will increase to 446 degrees F. There will be no appreciable change in the present feedwater pressure of 1033 psig. Therefore, the safety-related portion of the MFS piping will not be affected by uprating.

The Main Feedwater Isolation Valve (MFIV) is designed for 1950 psig and 450 degrees F, wich will not be exceeded after uprating. Also, the change in flow rate from 15.85×10^6 lb/hr to 15.96×10^6 lb/hr after uprating will not affect the capability of the valve to close and provide isolation. The MFIV is designed to close with feedwater flow 3 1/2 times the current normal flow rate of 15.85×10^6 lb/hr.

3. You stated in your steam generator blowdown system (SGBS) evaluation that, at the uprated level, the processing capability of the blowdown system will be utilized to the extent required to keep the chemistry within specification. In fact, you indicate that the increase in feedwater/main steam flow at the uprated level is so small (less than 1 percent increase) that no impact on SGBS is expected. Provide further details regarding your evaluation which explains how this conclusion was reached.

Response

Primarily, the Steam Generator Blowdown System (SGBS) serves to remove impurities in the secondary side water from the following sources:

- Primary to secondary leakage;
- Main condenser leakage;
- Sodium carry-over from deep-bed condensate demineralizers;
- Wear of other secondary cycle components and piping.

It is unlikely that, after uprating, the water chemistry will be affected significantly from any of the sources listed above. The increase in Condensate, Main Feedwater, and Main Steam flow rate is less than one percent.

The Steam Generator Blowdown System has been provided with a continuous blowdown range of 60-360 gpm. The extent of processing required during normal operation is determined by the operator depending upon the secondary side water chemistry requirements. The blowdown rate of 360 gpm (90 gpm per Steam Generator) is for abnormal operation with excessive main condenser leakage. Therefore, during normal operation after uprating, the water chemistry requirement can easily be met by adjusting the blowdown rate.

4. In your proposal, concerning the reactor makeup water system (RMWS) evaluation, you stated that an increased spent fuel pool evaportion rate due to increased heat loads has been calculated. The present RMWS design provides sufficient makeup water for this demand. No other change in the demand for reactor makeup water is likely due to the uprating. Provide further details regarding your evaluation which explains how this conclusion was reached.

Response

The Reactor Makeup Water System (RMWS) supplies deaerated water for makeup and flushing operations throughout the nuclear steam supply steam auxiliaries, the radwaste systems, and the fuel pool cooling and cleanup system. Table 9.2-20 in the FSAR lists the various systems served by the Reactor Make-up Water System.

The water demands on the RMWS are not simultaneous, and the system was designed for the worst case demand. The RMWS transfer pumps and the storage tank were designed to deliver 120 gpm to the boric acid blending tee, which is equivalent to the maximum letdown flow from the Reactor Coolant System, and were also designed to deliver 150 gpm, as an alternate source, for cooling the contents of the pressurizer relief tank from 200 degrees F to 120 degrees F in one hour following a pressurizer safety valve discharge. These worst case demands on the RMWS are not affected due to uprating. (Refer to Section 6.1 of the NSSS Uprating Licensing Report, ULNRC-1471, Attachment 5, Appendix A.)

There will be some impact on RMWS due to the increased demand from the spent fuel pool due to an increase in evaporation rate. The new maximum evaporation rate calculated by Union Electric is 641 lbs/hr (approximately 1.30 gpm) as compared to the old rate of 355 lbs/hr (approx. 0.719 gpm). The RMWS is designed to provide 20 gpm to the spent fuel pool for makeup requirement. Therefore, this small increase can easily be accommodated.

5. You stated in your submittal that the only systems with an increase in flow rates are main feedwater, condensate, and main steam systems. You further state that this increase is less than one (1) percent and, therefore, will not have any significant impact on the flooding analysis in safety-related areas of the plant. Verify that the original analysis of flooding contains sufficient conservatism and margin to offset the impact of the increased flow rates in these systems in areas containing safety related equipment.

Response

Flooding was not considered to be a problem after uprating for the reasons described below.

The original flooding analysis was done in a very conservative fashion as indicated by the assumptions listed in Appendix 3B of the FSAR. The worst case pipe failure in each safety-related room was assumed and the maximum flood levels were based on a reasonable delay after the break or crack.

The safety-related areas that could be impacted by flooding due to an increase in the Main Feedwater, Main Steam, and Condensate Flow rates, are the MFIV/MSIV compartment and the Containment. For Main Feed/Main Steam Isolation Valve compartment, the original maximum flood level was calculated for a feedwater break which was the worst case. This was considered in spite of the fact that this is a "No Break Zone". The most limiting single failure, a Main Feedwater Control Valve failure in the fully open position, was assumed. It was assumed that the plant is operating at 100 percent power and to maximize the water which has to be drained from this area, it was assumed that all the fluid discharged from the break will remain water. In spite of all this conservatism, there was sufficient drainage available such that the maximum water level in Rooms 1508 and 1509 was zero, and in Rooms 1411 and 1412 was 1'-4" (Reference FSAR Table 3.6-6). Since a flood level as high as 3'-0" is acceptable in this area, an increase of less than one percent in feedwater flow after uprating does not pose any problem.

Inside containment, the worst possible flood level after a MSLB was calculated to be at Elevation 2004'-5". This was calculated conservatively assuming a slow operator action (31.5 minutes). The total mass input into the containment was 3,834,725 lbm from several sources such as Blowdown, Aux. Feedwater, Reactor Water Storage Tank, etc. The mass input from main steam blowdown, which will be the only source affected due to uprating, was only 301,034 lbm. Therefore, no change in maximum flood level is expected after uprating when the main steam flow increases by less than one percent. Also, note that the worst flood level in the containment is from LOCA which is 2004'-6".

6. Provide a legible, full size copy of Figure 1 - Valves Wide Open (VWO) Heat Balance.

Response

Enclosure A provides a copy of the VWO Heat Balance and also a copy of the current 100% (of 3425 MWt NSSS) Heat Balance for comparison. Note that versions of these heat balances are also in the FSAR as Figures 10.1-2 and 10.1-3.

7. As part of your request to increase the power level at the Callaway Plant by 4.5%, you stated that "in order to confirm that equipment qualification will not be affected, all equipment inside containment was reviewed." In order to concur with your conclusions, the staff needs the following additional information: a) Provide the results of your review including any changes that are required to update your Equipment Qualificaton Program as stated in FSAR Section 3.11(B) and FSAR Table 6.2.1-2. This review should consider all applicable equipment in harsh environments both inside and outside containment. In addition to the obvious changes that may appear in FSAR Section 3.11, discuss any changes in previously postulated mild environment(s) (e.g., are any of these areas previously considered to be mild environments now harsh due to the increase in power level). If there are new areas that are now considered to be harsh, all equipment within the scope of 10CFR50.49 must be environmentally qualified accordingly; b) Identify and discuss change(s) in environmental profiles (i.e., pressure, temperature, radiation and humidity) for both normal operating conditions and accident conditions resulting from the power uprating; c) As a result of any postulated increase in normal operating temperature, discuss the affects of such changes on the qualified life of essential equipment (i.e., if the "10-degree C rule" is used for calculating qualified life, note that an increase of 10 degrees C will reduce the qualified life by 50%. Also note that significant changes in qualified life also occur with relatively small changes in temperature when using the Arrhenius methodology).

Response

(a) FSAR Section 3.11(B).1.2.2 will be updated to include the discussions on pages 11 and 12 of ULNRC-1471, Attachment 5, Appendix B, Section I (3/31/87). This addresses the four additional 102% uprated power MSLB cases and the evaluation demonstrating no EQ impact. In addition, FSAR Figures 3.11(B)-2 and 3.11(B)-3 will be revised to reflect the envelope of Figures 3, 5, 7, and 9 of the above referenced Section I. This will result in a slight adjustment to the EQ temperature profile while there will be no effect on the EQ pressure profile. No changes are needed for FSAR Table 6.2.1-2, since peak MSLB temperature and pressure parameters are unaffected (i.e., 384.9 degrees F and 48.1 psig); however, Section 6.2.1.4.1.4 will be revised to reflect modeling assumptions discussed in Section 6.2 of ULNRC-1471, Attachment 5, Appendix A. In addition, FSAR Table 6.2.1-57 will be revised regarding initial conditions (e.g., steam pressure, steam generator inventory, mass added by feedwater, etc.) and FSAR Table 6.2.1-58 will be updated to reflect Table 3 of ULNRC-1471, Attachment 5, Appendix B, Section I.

As stated on page 12 of the above referenced Section I, there is no EQ impact on Class 1E equipment inside containment. The effects of uprating have also been considered in the SNUPPS submittal on Information Notice 84-90 regarding MSLB's outside containment (steam tunnel) with superheated blowdowns (SLNRC 86-06 dated 4/4/86 and ULNRC-1473 dated 3/24/87). No areas previously considered to be mild environments will be changed to harsh environments as a result of the uprating. This is due to the insignificant process temperature changes discussed in (b) below and, as discussed on page 15 of the above referenced Section I, there will be no effect on pipe break locations, jet impingement analyses, or moderate energy cracks. As discussed in FSAR Section 3.11(B).1.2.3, HELB's outside containment include main steam line, main feedwater line, CVCS, and auxiliary steam line breaks. The feedwater line break is enveloped by the above MSLB dicussion whereas process conditions for CVCS and auxiliary steam lines are unaffected by the uprating.

(b) There are no environmental profile changes for normal operating conditions due to the uprating. As discussed in Table 2-1 of ULNRC-1471, Attachment 5, Appendix A and in Table 1 of ULNRC-1471, Attachment 5, Appendix B, Section I, there will be only slight changes to process temperatures and flows. Average RCS temperatures remain the same; steam temperatures decrease slightly; design feedwater temperature increases by 1.5 degrees F; and steam and feedwater flow increase by less than 1%. The increased decay heat load on the RHR heat exchangers in rooms 1309 and 1310 of the auxiliary building pertains only to shutdown conditions. The increase in time (3.3 hours) to cool the RCS from 350 degrees F to 140 degrees F will not adversely affect post-DBA operability of Class 1E equipment in rooms 1309 and 1310 since the calculations that demonstrate this operability in our EQ files (Arrhenius extrapolations) disregard the first 24 hours of the test profile. As discussed in ULNRC-1571 dated 8/7/87 and ULNRC-1561 dated 7/28/87, total CCW heat exchanger loads actually decrease from those reported in the FSAR.

The only accident environment profile changes are those discussed in (a) above.

(c) Qualified lives of Class 1E equipment are based on 120 degrees F inside containment and in the steam tunnel and on 104 degrees F in other areas of the auxiliary building. Actual ambient temperatures are 10-35 degrees F lower than these values. There will be negligible increases in heat loads for the containment cooling and auxiliary building HVAC systems. As such, there will be no effects on equipment qualified lives due to the uprating.

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