JCP&L / GPU

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July 31, 1980
EAJK-80-372

Director, Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Core Spray System

Our letter dated July 2, 1980 provided the results of an "Oyster Creek Core Spray Line Break Study" which was performed by Exxon Nuclear Company (ENC) at our request. This study summarized the results of an analysis which demonstrated the capability of Oyster Creek to meet the 10CFR50.46 and Appendix K requirements for a core spray line break as long as the core spray inventory is added to the reactor vessel.

As you have requested in your letter of July 9, 1980, enclosure 1 provides the technical information which supports the summary information provided in our July 2, 1980 letter.

The Exxon Nuclear Company letter to G. R. Bond referenced in Enclosure 1 contains the summary information provided in our July 2, 1980 letter. Also please note that the reflood times provided by Attachment 1 of our July 2 letter and Enclosure 1 of this letter differ by 9 seconds. The times stated in Enclosure 1 are correct and in no way affects the conclusions of the anlaysis.

If you should have any further questions regarding these submittals, please contact Jim Knubel (201-455-8753) of my staff.

Very truly yours,

Ivan R. Finfrock, Jr.
Vice President

8008050172

DETAILS OF OYSTER CREEK SPARGER CRACK CALCULATIONS

In November 1978, Exxon Nuclear Company reported results of calculations showing the Oyster Creek reactor could experience a core spray line break LOCA with failure of cracks in the unbroken spray sparger and still meet the NRC 10 CFR 50.46 criteria(1). This analysis assumed that although the cracked sparger could not be guaranteed to deliver the required spray cooling, the water inventory associated with the spray flow would still be delivered to the reactor vessel. Thus, for the core spray line break, if the spray were not effective in terminating the LOCA temperature transient, the vessel water inventory would increase and the LOCA temperature transient would be terminated by bottom reflood.

Since the ENC core spray line break blowdown calculation to the time of rated core spray delivery does not consider spray cooling, the results remain valid for the broken sparger case. Thus, if the time to reflood the core can be determined, it is possible to perform a conservative heatup calculation. The conservative heatup calculation uses the approved ENC calculation for blowdown and neglects convective heat removal following blowdown until reflood to the core midplane occurs. At the time the core midplane refloods, the allowed 10 CFR 50 Appendix K reflood heat transfer coefficient of 25 BTU/hr-ft^2°F will terminate the LOCA temperature transient.

To conservatively estimate the time of core midplane reflood, the following procedure was used:

(1) The volume to fill all reactor components to the core midplane was determined.

(2) The mass of fluid remaining in the reactor vessel and the recirculation loops at the end of the blowdown calculation (time of rated spray) was obtained directly from the RELAP4-EM results.

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(1) Letter L.J. Federico to G.R. Bond "Oyster Creek Core Spray Line Supplemental Analysis", Serial LJF-297-78 dated 12/18/78.

(3) The additional mass required to fill the system with collapsed liquid to the core midplane was determined from the above results and the fluid density.

(4) Mass balance calculations were performed to determine the time required to supply the additional mass. The time to reflood is then the time to rated spray plus the time to reflood to the core midplane.

The mass balance calculations considered mass loss due to break flow and flow through the ADS valves, and mass addition from the core spray system. The break flow rate was calculated by RELAP4-EM to be 146 lbm/sec at the time of rated spray (527 seconds) and was conservatively assumed constant at this value for the remainder of the LOCA transient. The time of ADS shutoff at 50 psia was obtained by plotting and extrapolating the RELAP4-EM calculated system pressure results. A shutoff time of 700 seconds was determined. From ADS flow vs. backpressure data, an average flow rate of 67.5 lbm/sec was derived over the time period of 527-700 seconds. Likewise, the spray flow was determined based on flow vs. backpressure data, and an average flow of 525 lbm/sec was found for the 527 - 700 second time period and approximately 546 lbm/sec after 700 seconds.

Integrating these average flow rates until sufficient mass was added to fill the system with collapsed liquid to the core midplane gave a reflood time of 875 seconds or 348 seconds beyond the time of rated spray.

The HUXY program was used to compute the conservative temperature transient for this case. The blowdown results from the core spray line break were used until the 527 second time of rated core spray, and following this time, the convection or spray heat transfer coefficients were set to zero. This results in an adiabatic fuel assembly calculation following the time of rated spray, but still allows rod-to-rod and rod-to-cannister radiation. HUXY gave a maximum cladding temperature of 2088°F at 890 seconds on this basis. Thus, reflood will terminate the Oyster Creek core spray line break LOCA temperature below 2100°F and within 10 CFR 50.46 limits based on these results.