JCP&L / GPU

Jersey Central Power & Light Company
Madison Avenue at Punch Bowl Road
Morristown, New Jersey 07960
(201) 455-8200

July 7, 1980

Director of Nuclear Reactor Regulation
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 June 27, 1980 provided as an attachment an evaluation of possible cracks on segments of the core spray piping within the reactor vessel between the inlet nozzle and the vessel shroud. As a result of our continued evaluation of this problem, our original submittal must be updated.

General Electric performed an evaluation of cyclic stresses induced by low level dynamic inputs. The conclusion drawn from the evaluation is that the possible crack size could increase on the order of 1 to 10 mils per day but it is not expected to grow beyond 8" total length during the next fuel cycle. The attached replacement pages address this mechanism.

Would you please replace the appropriate pages of our enclosure of June 27, 1980. If you should have any further questions, please contact J. Knubel (201-455-8753) of my staff.

Very truly yours,

Ivan R. Finfrock, Jr.

Ivan R. Finfrock, Jr.
Vice President

la

8007090259 P

2. Stress Due to Normal Operating Conditions

During normal operation, the core spray piping ~~is~~ ~~subjected~~ to loads due to the vertical and radial differential thermal expansion between the stainless steel shroud and the carbon steel reactor vessel. Piping stress analyses indicate that the stresses in the reducers due to heat-up to normal operating conditions are approximately 17,000 psi. This stress level is well within accepted allowables for thermal expansion stress and would not result in crack initiation due to low cycle fatigue. No other sources of thermal fatigue loads have been identified.

3. Flow Induced Vibration

The possibility of high cycle fatigue cracking due to flow-induced vibration has been evaluated. Possible excitation loads and frequencies due to vortex shedding at the maximum anticipated flow rates in the region of the core spray piping were estimated and dynamic analyses of the core spray piping were performed. The results of these analyses indicate that the lowest natural frequency of the piping is approximately 10 to 12 Hz as compared to an expected vortex shedding frequency of 4 to 6 Hz (8 Hz maximum based on the most conservative assumptions). Further, dynamic stress analyses performed by General Electric Company (GE) show that even if vortex shedding were to excite the piping, the resulting alternating stresses are very low (200 psi). These stress levels are not sufficient to explain the observed indications.

4. Installation Marks

It is considered possible that the linear indications on the reducers could be the result of tool or die marks from the forging process or could be related to installation methods. The assumption that the indications are tool or die marks or surface scratches from other causes is not inconsistent with their appearance.

Based on the available data and analyses, it cannot be ascertained whether the observed indications are relevant flaws or surface marks and a definitive explanation for their presence has not been identified. Accordingly, the significance of the indications has been evaluated on the conservative assumption that they are through-wall cracks.

B. Significance of Indications

On the basis of the visual inspections, it has been assumed for analysis purposes that a 4-1/2 inch long by 0.030 inch maximum width, through-wall crack exists in each of the 6 x 5 reducers. The effect of such a defect has been evaluated for normal and accident loads. The results of these evaluations are as follows:

1. Normal and Seismic Loads

As indicated above, stresses at the reducers due to worst-case normal operating conditions (specifically, heat-up/cool-down) are approximately 17000 psi. Stresses due to a postulated seismic event would add less than about 2000 psi to this number.

Crack propagation analyses performed by General Electric indicate that the propagation of a 4-1/2 inch crack due to five heat-up/cool-down cycles would be insignificant. Therefore the growth of such a crack due to the possible number of heat-up and cool-down cycles during a fuel cycle is of no concern.

Crack propagation analyses have also been performed by GE for an assumed vibratory loading, specifically in order to address the amount of growth which could occur in a 4.5 inch through wall crack in the reducers. Assuming a stress level consistent with the present crack length, estimates of crack propagation over the next operating cycle were made. These range from .5 to 3.5 inches with the projected flaw size at the end of the next cycle equal to or less than 8 inches. Since there are no primary loads on the core spray piping during normal operation, it is concluded that the integrity of the system during normal operation will be maintained with the presence of even an 8 inch flaw in each reducer.

2. Core Spray Injection Loads

During a core spray injection event, the core spray piping would be subjected to relatively cool (e.g. 80°F) water. This thermal transient subjects the initially 550°F piping to:

(1) transient "skin" thermal stress which are are of consequence for a single cycle and,

(2) differential thermal expansions between the cold piping and the 550°F shroud and reactor vessel.

Analyses of the thermal expansion stresses at the reducer show that the thermal mis-match between the core spray piping and its end points is less during an injection transient than during normal, steady-state operation. The maximum stress intensity in the reducer during the injection is calculated to be approximately 5000psi. Average membrane stresses in the axial direction (i.e., in a direction tending to open the assumed cracks) are less than 10% of this combined stress.

The presence of the assumed 4-1/2 inch crack and the boundary end of cycle crack size of 8 inches in each reducer has been evaluated by General Electric for all the design loads associated with a core spray injection transient. The results of these analyses indicate that even the 8 inch upper limit crack would be acceptable.

C. <u>Core Spray Hydraulic Analyses</u>

Hydraulic analyses have been performed by General Electric to evaluate the effect of through-wall cracks on core spray system effectiveness. For the purpose of these analyses, it was assumed that an 8 inch crack exists in each reducer and that these cracks open to .115 inch at the center and taper to the ends. The results of these analyses show that the minimum flow through any nozzle is maintained at the minimum required flow corresponding to a system design flow of 3400 gpm. These assumed leaks outside the shroud have no effect on core spray distribution. Accordingly, it is concluded that the presence of significant through-wall cracks in the core spray piping in the vessel between the inlet nozzle and the shroud will not degrade the effectiveness of Core Spray System II below original design values. The conclusion applies to the 4 1/2 inch cracks which are assumed to exist in the reducers and also to the crack length of 8 inches based on GE's postulated growth mechanism.