UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 34 TO PROVISIONAL OPERATING LICENSE NO. DPR-16

JERSEY CENTRAL POWER AND LIGHT COMPANY

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

INTRODUCTION

By letter dated November 15, 1978, Jersey Central Power and Light Company (JCP&L) requested an amendment to Provisional Operating License No. DPR-16. The amendment would modify the Technical Specifications for the Oyster Creek Nuclear Generating Station to specify the augmentation of inservice inspection for the core spray systems and will redefine the definition of operability for core spray system 2.

DISCUSSION

During the 1978 refueling outage, JCP&L discovered a crack in the sparger of Core Spray System 2 of the Oyster Creek emergency core cooling system (ECCS). The Oyster Creek ECCS has two single-active-failure proof core spray systems each of which can supply sufficient core spray flow to fully justify the spray cooling assumed in the Loss-Of-Coolant-Accident (LOCA) analyses. The crack in the sparger affects one of these two systems.

After being notified by JCP&L of the crack, the NRC staff met with the licensee on November 3, 1978, (Reference 4) to review the proposed repair and to determine the significance of the crack on Oyster Creek operation. The NRC staff has reviewed the repair to the sparger and has evaluated the effects on structural integrity of the sparger, core spray flow, and spray distribution. The staff has considered the explanation of the mechanism for the initiation and propogation of the crack and the reasons why additional cracking is not expected to occur. Additional surveillance of the Oyster Creek core spargers is being initiated to provide added assurance that no further significant cracking will go undetected.

The NRC staff has closely monitored the investigation as it progressed from inspection to an identification of the cause of the crack and repair of the sparger.

The purpose of this evaluation report is to summarize the staff's conclusions that the probable cause of the crack has been identified and understood, and that the repair used is adequate and returns the ECCS to a safe configuration essentially the same as identified by the approved Final Safety Analysis Report and current ECCS-LOCA analyses.

The staff has concluded that the operation of Oyster Creek in the repaired configuration does not constitute a significant hazards consideration. Operation in the repaired configuration neither increases the likelihood of an accident, increases the magnitude of its consequences nor adds the possibility of previously unconsidered accidents.

DESCRIPTION OF THE CRACK

The Core Spray Sparger for System 2 consists of 3 1/2 inch schedule 40 type 304 stainless steel pipe formed in two semi-circles held in place with brackets attached to the core shroud. Nozzles are welded into the bottom of the pipe approximately every 5 inches to direct the flow of water directly on the fuel bundles in a pre-established pattern. The circumferential crack is approximately 1/32" wide at its widest point and extends approximately 200 degrees around the sparger. It is located at an azimuth location of 208 degrees in the reactor vessel. This is approximately 58 degrees from the inlet and 32 degrees from the end of the sparger arm. The crack is through the wall, as determined by pneumatic testing, and is smaller inside the pipe than on the outside. The crack appears to have initiated close to one of the spray nozzles and is adjacent to one of the support brackets.

Because of the design of the sparger and the mounting brackets, JCP&L has concluded that the sparger would have been held in place if called upon for operation even if the crack had propagated completely around the pipe circumference before it was discovered. We have reviewed the design of the sparger and agree that because of the way the pipe is supported, the sparger would have been held in place in the event the core spray was initiated with the pipe severed.

DESCRIPTION OF THE REPAIR

The upper core spray sparger repair consists of the addition of a bracket assembly to provide axial support to the core spray piping in the vicinity of the crack. The bracket assembly is constructed of Type 304 solution annealed stainless steel and is held in place by four 3/4 inch bolts that are pre-loaded and locked in place by Class A type locking caps. The bracket assembly was fitted around the existing spray nozzles on both sides of the crack to provide axial support to the core spray sparger in the event the existing crack propagates completely around the pipe circumference.

The repair was performed remotely and the final examination to ensure proper fitup was recorded on video tape. The bracket assembly in place was examined at both ends and confirmation of proper fit was made and recorded.

ASPECTS OF REVIEW

The design, installation procedures, and structural analysis of the bracket assembly for all loads due to normal operations and accident conditions were reviewed to ensure the capability of the bracket assembly to limit the crack opening in the event the existing crack propagates completely around the pipe circumference. In addition, the structural analysis of the core spary sparger for all loads associated with the installation of the bracket assembly including seismic and differential thermal expansion loadings was reviewed for conformance with the appropriate portions of Section 3.9 of Standard Review Plan, and for the pipe's susceptability to further cracking.

EVALUATION

The analysis, design and installation of the repair bracket assembly are in accordance with accepted criteria. The analysis of the structural loads imposed by static, seismic and thermal loadings demonstrates that the bracket assembly will keep the sparger in place and will limit the crack opening to 1/16 inch in the event the existing crack propagates completely around the pipe circumference. The analysis of the structure loads imposed by static, seismic, thermal loadings and the loads associated with the installation of the bracket assembly on the core spray sparger is in accordance with the appropriate portions of Section 3.9 of the NRC Standard Review Plan.

Since the stresses from normal operating loads in the core spray sparger are well below the yield stress of the stainless steel material, crack growth in this line due to stress corrosion would not be expected to occur. However, the possibility of fitting the pipe into position during the installation could have resulted in stresses large enough to propagate a stress corrosion crack. Since the opening of the crack relieves the stresses in other locations in the core sparger, the susceptability of the other locations to stress corrosion cracking due to high installation stresses has been reduced.

We find that the addition of the bracket assembly is acceptable and will limit the crack opening to 1/16 inch in the event of a complete severance of the cracked section. We further conclude that reasonable assurance exists that further cracking jeopardizing the structural integrity of the core spray sparger would not occur during the next cycle of operation.

The licensee has proposed augmented inservice inspection of the core spray spargers to assure that additional cracking does not occur. The licensee proposed to examine the spargers at the next 5 refueling outages starting with the 1979 refueling outage and then every five years thereafter. We have modified the technical specifications to require JCP&L to submit a special report of each inspection prior to startup of the following cycle. Based on review of the core spray sparger structural analysis, we conclude that reasonable assurance exists that further cracking to the extent that the structural integrity of the sparger would be jeopardized would not occur in the intervals between inspections and therefore we find the proposed technical specifications acceptable.

CORE SPRAY DISTRIBUTION WITH REPAIRED SPARGER

JCP&L has provided the results of calculations for flow within the cracked sparger (Reference 1) which conservatively demonstrate that flow from each nozzle will be within an acceptable range and will therefore produce an acceptable spray distribution (as described below). The calculations for flow within the sparger include effects of maximum flow through the crack, which was arbitrarily assumed to have opened to the maximum width (1/16") permitted by the newly installed sparger repair. (The calculational methods have been applied to an uncracked sparger, and the results compare well with previously performed measurements, thus demonstrating the acceptability of the methods used to calculate flow from each nozzle.)

Previously performed core spray distribution tests were utilized to determine the acceptable range of flows from each spray nozzle that will produce an acceptable spray distribution. Those previous tests were performed at the Vallecitos full scale spray distribution test facility and were performed for single sparger flow rates from 3100 to 4500 gpm. For sparger flows in that range, the test results showed that the core spray distribution is adequate to support use of the core spray cooling coefficients assumed in the current ECCS-LOCA analyses (References 2 and 3).

The present (repaired) system, assuming the maximum width crack, will be comprised of one portion of the sparger (that portion on the side of the crack away from the supply pipe) with spray nozzle flow rates slightly lower than spray nozzle flow rates from the rest of the spray nozzles. However, all spray nozzles flow rates will be in the range where acceptable resulting distributions have previously been demonstrated (as described below) when total system flow supplied to the sparger is above the 3640 gpm to be required by the revised Technical Specification. It is our judgement that the distribution resulting from this combination of slightly different flow rates from different portions of the sparger will not be significantly different from distributions previously measured (and found acceptable). This is based on the previous spray distribution measurements which used an uncracked sparger and showed typical variation between nozzle flow of around 35% (i.e., 35% more from nozzles near the inlet than from nozzles near the sparger end). This variation would be increased to only about 40% with an assumed 1/16" crack, which is an insignificant change in the variation.

We therefore find that the distribution in spray flow from the repaired sparger will not be significantly different from the previously accepted distribution from the uncracked and unrepaired sparger.

ACCEPTABILITY OF ECCS-LOCA ANALYSES WITH UNDETECTED COMPLETE SEPARATION OF ANY PORTION OF ONE CORE SPRAY SPARGER

Even in the unlikely event that a portion of one core spray sparger were to become separated so that the separated portion could not receive (and distribute) flow, there is sufficient redundancy built into the ECCS at Oyster Creek (for other purposes) to make this an acceptable condition that meets the requirements of 10 CFR 50.46. Even though the conditions described below are not required, events that must be analyzed (they involve a pipe break, passive failure of a core spray sparger, plus the worst active component failure), and even though such a condition is not believed credible (acceptability of the repair is described within this SER), this description is provided to demonstrate the margin that is present in the Oyster Creek ECCS.

Each of the two Oyster Creek core spray systems is single-active-failure proof. That is, sufficient emergency power systems, valves, and pumps are provided so that no active single failure can prevent either one of the two core spray systems from distributing, by itself, sufficient core spray flow to fully justify the spray cooling credit assumed in LOCA analyses.

This redundancy is provided so that a core spray line break (which completely disables one core spray system), together with the worst assumed single failure in the remaining ECCS equipment, which includes the other core spray system, will have acceptable results. The LOCA calculations for the core spray line break show that the core is never uncovered for this (top) break (Reference 2). Therefore, core spray distribution is not required and in fact is meaningless with water levels above the core. Moreover, since flow for inventory purposes would still be provided by a damaged sparger, and since that is all the analyses took credit for, the results would be unchanged even with undetected damage to a core spray sparger (i.e., the core spray break would have identical, acceptable results with a damaged sparger).

For a bottom break, we again note that no single active failure can prevent either of the core spray systems from fulfilling its design purpose. Therefore, if one sparger is damaged and incapable of properly distributing its flow, the other sparger will provide an acceptable spray flow distribution.

Therefore, even though the above described conditions are not considered credible and did not have to be analyzed for this purpose, existing analyses show, as stated above, that the consequences of even this extreme set of conditions are acceptable.

JCP&L has proposed technical specification changes to redefine the requirements of the core spray systems. Current technical specifications define the requirements of operability of the core spray systems. JCP&L has proposed to change the basis for determining what constitutes an operable system. For core spray system 1 the demonstrated capability of delivering at least 3400 gpm within 35 seconds of a worst line break is required. JCP&L proposes to redefine the demonstrated operability of core spray system 2 to require at least 3640 gpm within 35 seconds of a worst line break.

Because of the evaluation of the core spray distribution with an assumed circumferential crack in sparger 2, we find the proposed change necessary and acceptable.

ENVIRONMENTAL CONSIDERATION

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: November 24, 1978

References

1. Repair Proposal No. 320-78-1, Oyster Creek Nuclear Generating Station Core Spray Sparger No. 2, JCP&LCo, November 15, 1978, with Attachment 1 (Safety Evaluation) and 2 (Core Spray Evaluation).

2. Letter to Director of NRR from I. Finfrock, JCP&L, October 3, 1978, Supplemental Information on Technical Specification Change Request #49, Rev. 1.

3. XN-NF-77-55, Rev. 1, O. C. LOCA Analyses using the ENC NJP-BWR ECCS-Even March 1978.

4. Summary of November 3, 1978 meeting to discuss Proposed Repair of the Cracked Core Spray Sparger at the Oyster Creek Nuclear Generating Station, November 22, 1978.