ATTACHMENT 1

SHEARON HARRIS NUCLEAR PLANT INDIVIDUAL PLANT EXAMINATION

STAFF EVALUATION REPORT

I. INTRODUCTION

On August 20, 1993, Carolina Power and Light Company submitted the Shearon Harris Nuclear Power Plant (SHNPP) Individual Plant Examination (IPE) in response to Generic Letter (GL) 88-20 and associated supplements. The licensee performed a full scope Level 2 PRA as its IPE. On October 12, 1994, the staff sent questions to the licensee requesting additional information. The licensee responded in letters dated January 25, 1995 and September 18, 1995.

A "Step 1" review of the SHNPP IPE submittal was performed and involved the efforts of Science & Engineering Associates, Inc., Scientech, Inc./Energy Research, Inc., and Concord Associates in the front-end, back-end, and human reliability analysis (HRA), respectively. The Step 1 review focused on whether the licensee's method was capable of identifying vulnerabilities. Therefore, the review considered (1) the completeness of the information and (2) the reasonableness of the results given the SHNPP design, operation, and history. A more detailed review, a "Step 2" review, was not performed for this IPE submittal. A summary of contractors' findings is provided below. Details of the contractors' findings are in the attached technical evaluation reports (Appendices A, B, and C) of this staff evaluation report (SER).

In accordance with GL 88-20, SHNPP proposed to resolve Unresolved Safety Issue (USI) A-45, "Shutdown Decay Heat Removal Requirements" and USI A-17, "Systems Interactions in Nuclear Power Plants". No other specific USIs or generic safety issues were proposed for resolution as part of the SHNPP IPE.

II. EVALUATION

SHNPP is a Westinghouse 3-loop PWR with a large dry containment. The SHNPP IPE has estimated a core damage frequency (CDF) of 7E-5/year from internally initiated events, including the contribution from internal floods. The SHNPP CDF compares reasonably with that of other Westinghouse 3-loop PWR plants. loss of coolant accidents contribute 40%, station blackout 26%, transients with loss of decay heat removal (DHR) 11%, and internal flooding 7%. The important system/equipment contributors to the estimated CDF that appear in the top sequences are: high head safety injection (HHSI), residual heat removal (RHR)/low head safety injection, diesel generators (DGs), auxiliary feedwater (AFW), service water (normal service water and emergency service water), heating ventilation and air conditioning for DGs and charging/HHSI pumps, component cooling water (CCW), DC power, engineered safety features actuation system, and instrument power. The licensee's Level 1 analysis appeared to have examined the significant initiating events and dominant accident sequences.

Based on the licensee's IPE process used to search for DHR vulnerabilities, and review of SHNPP plant-specific features, the staff finds the licensee's DHR evaluation consistent with the intent of the USI A-45 (Decay Heat Removal Reliability) resolution.

The licensee performed a HRA to document and quantify potential failures in human-system interactions and to quantify human-initiated recovery of failure events. The licensee identified the following operator actions as important in the estimate of the CDF: failure to restore offsite AC, failure to establish recirculation (CCW to RHR heat exchanger), failure to close valve 1SI-331 after testing, failure to implement feed-and-bleed cooling, failure to manually start AFW pump, failure to correctly calibrate pressure controller PC-9209B, failure to establish long-term injection source, failure to locally align offsite AC (late), and failure to correctly calibrate undervoltage sensing relays.

The licensee evaluated and quantified the results of the severe accident progression through the use of a containment event tree and considered uncertainties in containment response through the use of sensitivity analyses. The licensee's back-end analysis appeared to have considered important severe accident phenomena. Among the SHNPP conditional containment failure probabilities; early containment failure is 0.3% with hydrogen burns being the primary contributor; late containment failure is 5% with hydrogen burns being the primary contributor; bypass is 7% with steam generator tube rupture (SGTRs) being the primary contributor, and containment failure with in-vessel recovery (prior to vessel breach) is 3% with hydrogen burns being the primary contributor. The containment remains intact about 85% of the time. Early radiological releases are dominated by SGTR sequences and late releases are dominated by station blackout sequences. The licensee's response to containment performance improvement program recommendations is consistent with the intent of GL 88-20 and associated Supplement 3.

Some insights and unique plant safety features identified at SHNPP are:

1. After a plant trip, transfer of the offsite power from the unit auxiliary transformers to the startup transformers requires non-vital 125 V DC power for control power to circuit breakers. A failure of the non-vital 125 V DC power would result in a failure to provide offsite power to 1E buses.

2. A plant-specific containment failure mode involves direct liner attack by core debris from a high pressure-induced dispersal.

3. A procedure that requires an operator to restart the reactor coolant pump to provide core cooling would lead to thermally-induced SGTR. In response to an NRC question on the induced SGTR (due to reactor coolant pump restart), the licensee stated that the failure mode of steam generator tubes is not unique to the Shearon Harris plant, and that the issue is being addressed by the Westinghouse Owners Group.

The licensee identified the following improvements for implementation:

(1) A procedure change has been implemented to provide for manual operation of circuit breakers if the non-vital 125 V DC control power is lost.

(2) The testing and maintenance practices for the non-vital 125 V DC battery were verified to be equivalent to the practices for safety-related batteries.

With respect to potential improvements under evaluation, the licensee is investigating the feasibility of installing improved instrumentation for monitoring of the non-vital 125 V DC batteries.

III. CONCLUSION

Based on the above findings, the staff notes that: (1) the licensee's IPE is complete with regards to the information requested by Generic Letter 88-20 (and associated guidance NUREG-1335), and (2) the IPE results are reasonable given the SHNPP design, operation, and history. As a result, the staff concludes that the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the SHNPP IPE has met the intent of Generic Letter 88-20.

It should be noted, that the staff's review primarily focused on the licensee's ability to examine SHNPP for severe accident vulnerabilities. Although certain aspects of the IPE were explored in more detail than others, the review is not intended to validate the accuracy of the licensee's detailed findings (or quantification estimates) that stemmed from the examination. Therefore, this SER does not constitute NRC approval or endorsement of any IPE material for purposes other than those associated with meeting the intent of GL 88-20.