Penelec / GPU

GPU Service

JCP&L / GPU

GPU Nuclear

Met-Ed / GPU

GENERAL PUBLIC UTILITIES

GPU

9212040072 921118
PDR ADOCK 05000219
P PDR

OYSTER CREEK NUCLEAR GENERATING STATION

STRUCTURAL EVALUATION OF THE SPENT FUEL POOL

TOPICAL REPORT 088
REV. 0

Project No: B/A 402880

Authors: Martha Gottberd
Date: 9/16/92 Martha Gottberd

Approvals:

Section Manager — Date 9/16/92

B Elam for D G Slear 9/16/92
Director Engineering & Design — Date

9.26
Vice President, Technical Functions — Date

ABSTRACT

A structural evaluation of the Spent Fuel Pool (SFP) at the Oyster Creek Nuclear Generating Station (OCNGS) was performed by ABB Impell Co. in order to evaluate the SFP concrete structure for consolidated and unconsolidated fuel loads in addition to other design basis loads (i.e. dead loads, live loads, thermal gradients, seismic loads and cask drop accident).

This analysis was performed in order to:

1. evaluate the impact of providing additional storage in the SFP using fuel rod consolidation,

2. determine the effects of the existing concrete cracks in the SFP slab and supporting structures,

3. determine the effects of the reduced embedment of the bottom SFP slab rebars into the supporting beams and walls.

A detailed finite element model of the SFP concrete structure with connecting and supporting members was generated for this analysis as described in detail in the attached ABB Impell Co. Report No. 03-0370-1341 Rev. 0. This model is of sufficient size and detail to predict cracking and to account for internal redistribution of forces. Thus, the model encompasses the northern half of the Reactor Building and includes all structural elements between elevation 23' and elevation 119'. The model includes sufficient detail to permit simulation of observed conditions including known cracks and as-built reinforcing details.

The results of the analysis described in the attached ABB Impell Co. report demonstrate that the OCNGS SFP meets the requirements of ACI349-80 for all load combinations in the OCNGS updated FSAR section 9.1.2.3. The general pattern of cracks observed in the SFP and connected structures as well as specific individual cracks are predicted by the analysis. The analysis demonstrates that the cracks do not jeopardize the structural integrity of the SFP or its connected structures.

TABLE OF CONTENTS

1.0 INTRODUCTION

The attached ABB Impell Co. Report No. 03-0370-1341, Rev. 0, "Oyster Creek Nuclear Generating Station Structural Evaluation of the Spent Fuel Pool" describes in detail the analyses performed to demonstrate the structural integrity of the SFP.

2.0 METHODS

2.1 An Analysis Criteria Document was developed which defines the general technical requirement as well as the detailed directions for their implementation. The Analysis Criteria Document is incorporated in the attached ABB Impell Co. Report as Appendix B.

2.2 A detailed finite element model of the SFP concrete structure with connecting and supporting members was generated using the ANSYS computer program in order to consider all required loads, load combinations and specific features of the SFP. The model is described in Section 2 of the Report.

2.3 The analysis considers the effects of dead loads, live loads, thermal gradients, seismic loads and cask drop accident using FSAR loads and load combinations. The evaluation of section capacities and stresses was performed in accordance with ACI349.

2.4 The specific features of the SFP and its supporting structures considered in the analysis are:

1. the reduced embedment length of bottom reinforcing bars connecting the SFP slab to supporting beams/walls,

2. the integral connection of the floor slabs and drywell shield wall with the SFP structure,

3. cracks on the concrete girder supporting the SFP (column line RE) and the bottom of the floor slab beneath the SFP north wall, as well as cracks on areas of the drywell shield wall connection to the SFP.

2.5 Analysis Cases A, B, C and D were considered during the analysis as listed below and as described in Section 3.2 of the Report.

Case A: Baseline analysis, normal plant operating loads with rack and fuel loads in place in 1983, thermal conditions (winter) that favored concrete cracking; no seismic and cask drop loads and only existing equipment live loads.

Case B: Same loads as Case A in addition to reduced embedment of the bottom slab rebar into the supporting structures.

Case C: Licensed condition. Normal plant operating loads and the fully loaded high density racks presently in place, summer and winter thermal gradients, design live loads, seismic loads and cask drop load. Reduced embedment rebar and existing cracks were considered.

Case D: Same loads and conditions as Case C except that consolidated fuel assemblies were assumed in the SFP.

Analysis Cases A and B were specifically developed to provide an understanding of the behavior of the pool under sustained mechanical loads and thermal gradients. During the course of the analysis, it was determined that the behavior of the pool and the formation of cracks could be simulated using Case C and that the results of Case C enveloped those of Cases A and B. Therefore, analysis Cases A and B were not finalized. Analysis Case D was completed to evaluate the effects of storing additional fuel to the spent fuel pool using consolidated fuel assemblies. The report therefore focuses on the results of analysis Cases C and D.

2.6 The behavior of the SFP structure is described in Section 4 of the Report.

3.0 RESULTS

3.1 The evaluation process and a summary of results are described in Section 5 of the Report.

3.2 The results of the analyses described in the Report demonstrate that the OCNGS SFP meets the requirements of ACI349-80 for all applicable load combinations. The general pattern of cracks observed in the SFP and connected structures, as well as specific individual cracks are predicted by this analysis.

3.3 Although the SFP structure can support consolidated fuel loads, this loading is not recommended due to the lack of any margin in one of the spent fuel pool supporting elements under consolidated fuel loads.

4.0 CONCLUSIONS

4.1 Conclusions are presented in Section 5.4 of the Report.

4.2 The structure is in full compliance with ACI349-80 for all loads for which the plant was licensed.

5.0 REFERENCES

5.1 ABB Impell - Report No. 03-0370-1341, OCNGS Structural Evaluation of the Spent Fuel Pool, Rev. 0, 6/29/92 Attachment to this TR.

5.2 ACI349 - Code Requirements for Nuclear Safety Related Concrete Structures, 1980.

5.3 OCNGS FSAR Update, Section 9.1.2.3.