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FINAL ASSESSMENT OF WATERFORD-3 FUEL STRUCTURAL INTEGRITY UNDER FAULTED CONDITIONS

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INTRODUCTION

This document formally transmits the final assessment of the Waterford-3 fuel structural integrity under faulted conditions. The anlytical techniques, models, and acceptance criteria used for the seismic and LOCA analyses follow the methodology described in CENPD-178, Rev. 1 (Ref. 1).

REFERENCES:

1) CENPD-178-P, Rev. 1-P, "Structural Analysis of Fuel Assemblies for Seismic and Loss of Coolant Accident Loading", C-E Proprietary Report, August 1981

2) Final Safety Analysis Report, San Onofre Nuclear Generating Stations Units 2 and 3, NRC Docket Nos. 50-361 and 50-362, Response to NRC Question 231.26

3) WSES-3 FSAR

FINAL SEISMIC AND LOCA FUEL ANALYSES

The seismic and LOCA analyses of the fuel followed a step-by-step procedure. In the first step, the input excitations to be used for the coupled reactor internals and core models were developed. These consisted of the horizontal, vertical, and rotational (rocking) time-history responses of the reactor vessel determined from the reactor coolant system analyses. The LOCA analysis also included the fluid pressure transient forces resulting from each postulated pipe break. These excitations were input into separate horizontal and vertical models of the reactor internals and core.

In the horizontal direction, the motions of the core plates and core shroud, which were used as input to detailed models of the reactor core, were obtained from the analyses of the coupled internals and core models. Separate core models were used to analyze rows of the core with different numbers of fuel assemblies. The seismic and LOCA horizontal direction core analyses were performed using models representing 17, 9, and 4 fuel assemblies in a row. For the vertical direction, the core response was obtained directly from the coupled internals and core model analyses.

The LOCA analyses were performed for a postulated 125 in^2 break (see Ref. 3, Section 3.6.2.1.1) at the reactor vessel inlet nozzle and a 600 in^2 break (Ref. 3, Table 3.1) at the steam generator inlet nozzle. The seismic analyses were performed for the Safe Shutdown Earthquake (SSE). These analyses provided the peak spacer grid one-sided and through-grid impact loads which were used in the final assessment of the Waterford-3 fuel.

The longest row case (17 fuel assemblies) provided the most severe impact loads in the seismic analyses, whereas, the highest LOCA loads were found in the shortest row case (4 fuel assemblies). Peak impact loads from both the seismic and LOCA analyses are summarized in Table 1. The resulting loads do not exceed the spacer grid strength, except in isolated locations in the four-assembly rows of the core.

An Emergency Core Cooling System (ECCS) analysis was performed to determine the coolability of these peripheral assemblies with reduced flow area due to grid deformation. The methodology and acceptance criteria used in this ECCS evaluation were identical to previous analyses of this type (Ref. 2). As documented in Ref. 3 (Section 4.2.3.1.3), the ECCS acceptance criteria were satisfied for the Waterford-3 spacer grids.

TABLE 1

COMPARISON OF SPACER GRID IMPACT LOADS WITH Pcrit VALUES

NUREG-0609, "Asymmetric Blowdown Loads on PWR Primary Systems, Resolution of Generic Task Action Plan A-2, January 1981", states that it is a sufficient LOCA acceptance criterion to show that combined loads on the grids remain below Pcrit. It is our position that it is not necessary to combine seismic and LOCA loads on the grids. For the convenience of the NRC review, the seismic and LOCA loads on the grids have been combined (by SRSS[1]) and compared to values of Pcrit.

Case Description	Peak[2] LOCA Loads (Lbs)	Peak[2] SSE Load (Lbs)	Peak[1] Combined Load (Lbs)	Pcrit[1] (Lbs)
17 Fuel Assembly Row	[			]
One-side load				
Through-grid load				
9 Fuel Assembly Row				
One-sided load				
Through-grid load				
4 Fuel Assembly Row				
One-sided load				
Through-grid load				

1 = The combined loads are obtained from the square root of the sum of the squares of the SSE and LOCA loads for the same grid (function of grid location).

2 = Designates the peak loads independently of grid location.